U.S. Army
Environmental
Center

Final Technical Work Plan

Remedial Investigation and Feasibility Study

of the

Defense Property Disposal Office

Fort George G. Meade, Maryland

Submitted to

U.S. Army Environmental
Center (USAEC)
Aberdeen, Maryland

May 1995

Prepared by:

Engineering Technologies Associates, Inc.
3458 Ellicott Center Drive #101
Ellicott City, MD 21043

DACA31-92-D-0045
Delivery Order 0010

**Distribution Unlimited,
approved for Public Release**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

List of Acronyms and Abbreviations

ADD	Average Daily Dose
AEHA	Army Environmental Hygiene Agency
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BRAC	Base Closure and Realignment Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDI	Chronic Daily Intake
COC	Chain-of-Custody
COR	Contracting Officer's Representative
CRAVE	Carcinogen Risk Assessment Verification Endeavor
DOI	Department of the Interior
DCE	1,1-Dichloroethene
DRMO	Defense Reutilization and Marketing Office
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
FGGM	Fort George G. Meade
FS	Feasibility Study
GC/MS	Gas Chromatography/Mass Spectrometry
GC	Gas Chromatography
GPM	Gallons Per Minute
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Indices
IR	Installation Restoration
IRDMIS	Installation Restoration Data Management Information System
IRIS	Integrated Risk Information Systems
IRM	Interim Reference Materials
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDE	Maryland Department of the Environment
MS	Mass Spectrometry
NAD27	North American Datum 1927
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NIST	National Institute of Standards and Technology
No.	Number
NPDWR	National Primary Drinking Water Regulations
NPL	National Priorities List
ODC	Other Direct Costs
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment

PCB	Polychlorinated Biphenyl
PCE	Perchloroethene
PID	Photoionization Detector
PP	Proposed Plan
PRI	Potomac Research, Inc.
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAC	Quality Assurance Coordinator
QAP	Quality Assurance Plan
QCP	Quality Control Plan
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
RI	Remedial Investigation
RIA	Remedial Investigation Addendum
ROD	Record of Decision
SARM	Standard Analytical Reference Material
SI	Site Inspection
SIA	Site Investigation Addendum
SLI	Site Location Identity
SQL	Sample Quantitation Limit
SVOC	Semi-volatile Organic Compound
TAL	Target Analyte List
TCA	1,1,1-Trichloroethane
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TEPS	Total Environmental Program Support
TWP	Technical Work Plan
USAEC	United States Army Environmental Center
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USC	Unique Sample Code
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) Technical Work Plan was prepared by Engineering Technologies Associates, Inc. (ETA) under Contract No. DACA31-92-D-0045, Delivery Order 0010, for the U. S. Army Environmental Center (USAEC). The study area is a storage facility for old vehicles, transformers and a variety of equipment. The site was formerly referred to as the Defense Property and Disposal Office (DPDO) Yard and is now known as the Defense Reutilization and Marketing Office (DRMO) Yard. This Work Plan has been developed in accordance with the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, United States Toxic and Hazardous Materials Agency (USATHAMA) Geotechnical Requirements, and the USATHAMA Quality Assurance Program (1990).

1.1 Objective of the Investigation

Under the 1988 Defense Secretary's Commission on Base Realignment and Closure Act (BRAC), approximately 9,000 acres of the 15,000 acre facility were designated for closure. In October 1991, 7,600 acres were transfered from the U.S. Army to the Patuxent Wildlife Research Center, south of Route 32. In January 1993, an additional 500 acres were also transfered and FGGM decided to retain the 308 acres including the Active Sanitary Landfill. Figure 1 is a map showing the physical location of the DRMO Yard in relation to the BRAC Land Parcels. The remaining 440 acres, including the Tipton Army Airfield, is scheduled for closure in September 1995. Figure No. 1 shows the DRMO site in relation to surrounding lands.

However, the Defense Reutilization and Marketing Office (DRMO) needs to determine whether a storage facility with documented contamination has or could have any environmental effect on the BRAC Land Parcel via hydrologic pathway(s). Therefore, the objectives of this focused RI/FS are to gather data and information to determine:

(i) If ground water and/or surface runoff flows south from the DRMO Yard to the BRAC Land Parcel, and

(ii) if either ground or surface runoff flows south, what would be the risk to human health and the environment as a result.

(iii) If it is determined that the site poses an environmental risk to the BRAC Land Parcel, a feasibility study will be completed to determine the appropriate technologies for the remediation of the DRMO Yard.

The overall objective of the RI is to perform site characterization, determine the type, nature and extent of contamination, identify Applicable or Relevant and Appropriate Requirements (ARARs) and assess potential risks to human health and the environment.

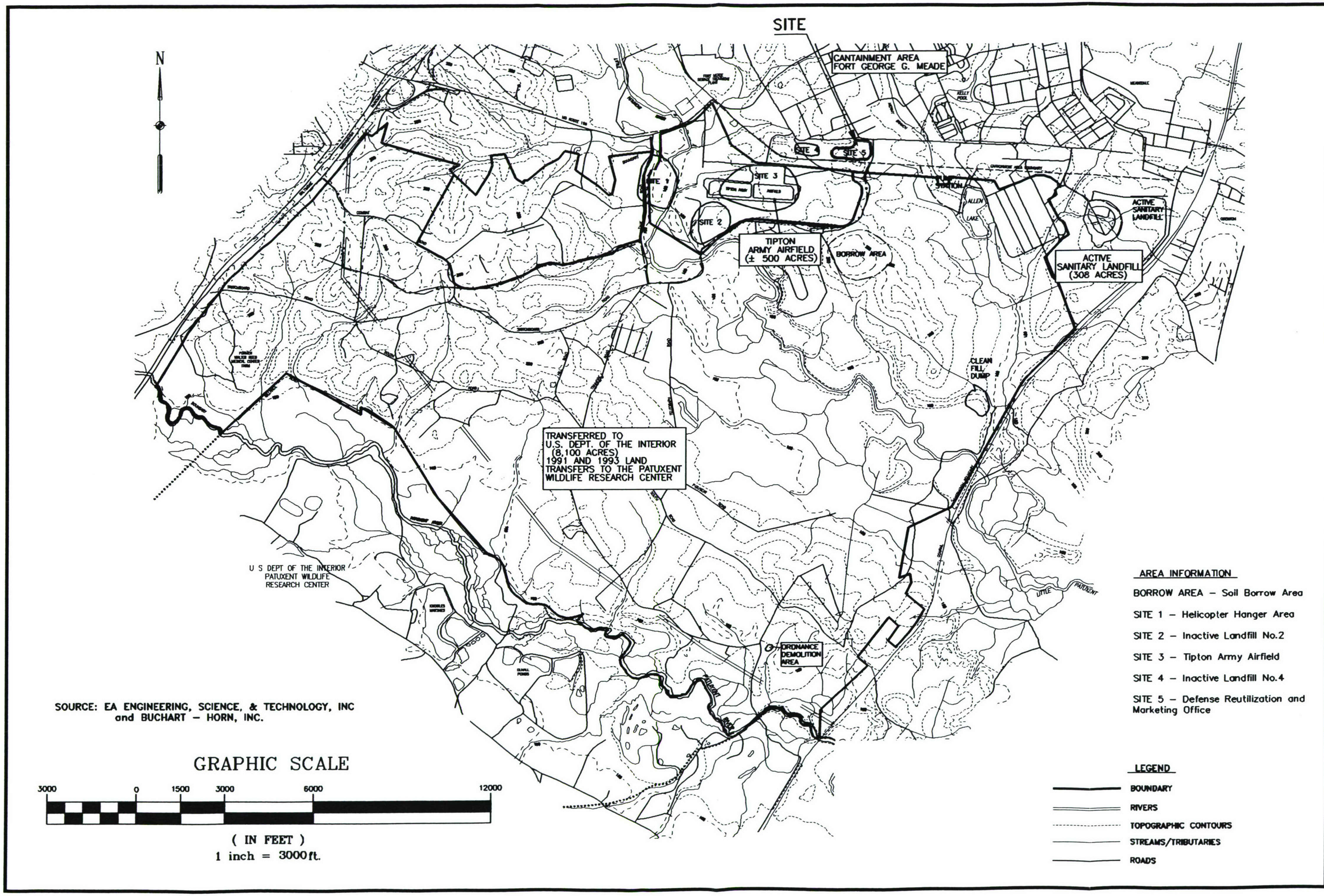


Figure # 1

FORT GEORGE G MEADE

DRMO Site and BRAC Land Parcels

SCALE: AS SHOWN	CONTRACT NO.: 92307.010	DATE: MAY 1995	SHEET: 1

ENGINEERING TECHNOLOGIES ASSOCIATES, INC.

ENGINEERS * PLANNERS * SURVEYORS

3458 ELLICOTT CENTER DRIVE SUITE 101
ELLICOTT CITY, MARYLAND 21043
BALTO. 461-9920 WASH. 621-4880

DESIGNED	C. J. C.	12/94 DATE
DRAWN	S. G. P.	05/95 DATE
CHECKED	K. K. W.	12/94 DATE
APPROVED	L. L. M.	12/94 DATE

The overall objective of the FS is to establish remedial action objectives, identify/evaluate potentially suitable technologies and assemble technologies into remedial action alternatives.

1.2 Scope of Work

The scope of work for this investigation is based on USAEC's Request for Proposal for a delivery order for Fort George G. Meade Remedial Investigation/Feasibility Study - Defense Property Disposal Office. The scope includes the following tasks:

- Site Reconnaissance and Data Review
- Project Plans
- Project Meetings
- Remedial Investigation
- Feasibility Study
- Final Reporting
- Management and Cost Reporting

This Technical Work Plan describes how the various tasks will be accomplished and provides the schedule for their completion.

1.3 Identification of Participatory and Regulatory Organizations

Facility Owner:	Department of the Army
Environmental Service Agency:	U.S. Army Environmental Center
Federal Regulatory Agency:	Environmental Protection Agency, Region III
State Regulatory Agency:	Maryland Department of the Environment

1.4 Supporting Documents

In support of the Technical Work Plan, the following documents have been provided to USAEC: the Quality Assurance Plan (QAP), the Health and Safety Plan (HASP), the Quality Control Plan (QCP), and the Management and Resource Utilization Plan. The QAP is included within the Technical Work Plan.

1.5 Document Organization

This Technical Work Plan is organized into the following sections:

- Section 1.0, Introduction: states the objective, supporting documents and Work Plan organization of the investigation

- Section 2.0, Site Background and Setting: provides a general description of the DRMO Yard including its history, previous investigations and geological information.

- Section 3.0, Initial Evaluation: provides a description of the site, what previous investigations have gone on there and what the results of those investigations have been.

- Section 4.0, Work Plan Objectives, Rationale and Technical Scope of Work: provides the components of each part of the Task Order.

- Section 5.0, Remedial Investigation/Feasibility Study Tasks: describes the activities necessary to complete the RI field investigation.

- Section 6.0, Chemical Analysis Program: describes the analytical program for samples collected during the field investigation.

- Section 7.0, Quality Assurance, Data Management, and Data Evaluation: describes the procedures necessary for quality assurance, data management and data evaluation.

- Section 8.0, Risk Assessment, Feasibility Study, and Community Relations: identifies methods for evaluating the Applicable Relevant and Appropriate Requirements (ARARs), performing the risk assessment and conducting the feasibility study.

- Section 9.0, Project Management: summarizes the project organization and personnel management.

- Section 10.0, Schedule: Presents the schedule for the RI and FS.

- Section 11.0, References: Lists the references consulted in preparing this Technical Work Plan.

2.0 SITE BACKGROUND AND SETTING

2.1 Site Description and General Description

Fort Meade is located in Anne Arundel County, MD, between Washington, D.C. and Baltimore. The entire installation includes approximately 5,000 acres and the closest city is Odenton, MD (Figure 2). Fort Meade has been in operation since 1917 and the current workforce includes approximately 20,000 people (A.D. Little, 1994).

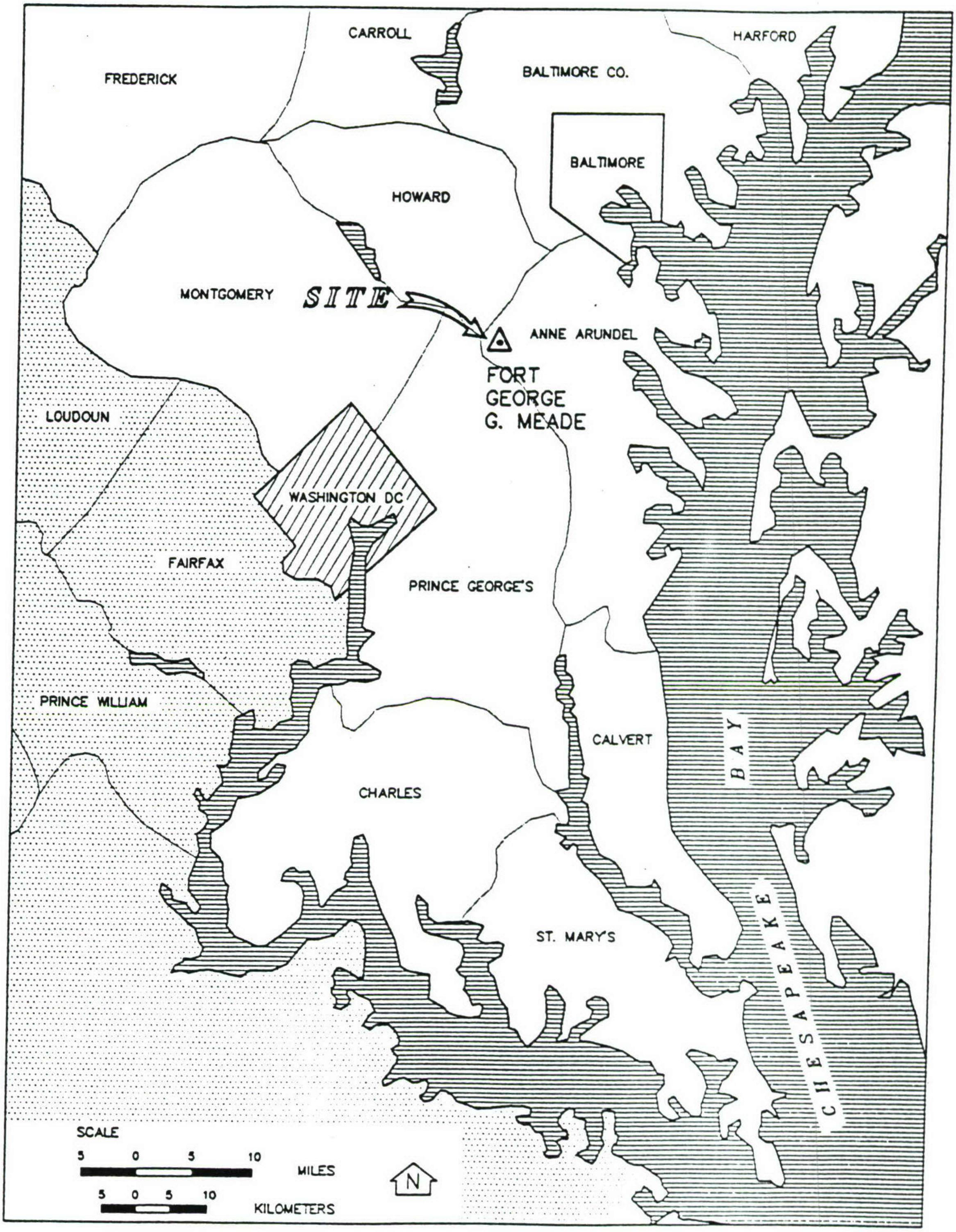
The DRMO Yard is located along Remount Road south of Rock Avenue immediately north of State Route 32 (Figure 3). The site covers an area of approximately 8.7 acres and is a storage area for various equipment, including vehicles, transformers, electronic equipment, heating and cooling units, pipes, dumpsters, and scrap metal (A.D. Little, 1994).

2.2 Site History and Previous Investigations

Two other studies have investigated the DRMO Yard. In 1992, EA Engineering, Science, and Technology, Inc. completed a Site Inspection (SI) which involved characterizing the stratigraphy and lithology of the subsurface materials, completing three and sampling four ground water monitoring wells, determining the direction and rate of ground water flow, and collecting surface soil samples.

In 1994, Arthur D. Little, Inc. completed a Site Inspection Addendum (SIA) investigation. The purpose of this investigation was to evaluate if any chemical releases or potential contamination had occurred at suspected sites and to determine if further investigation is warranted. Specifically at the DRMO Yard, this included further characterizing the presence of polychlorinated biphenyls in soils, further identifying the contamination source, monitoring ground water downgradient of previously investigated ground water and resampling all existing wells. During this investigation two monitoring wells were installed, and altogether, ground water samples were collected from six wells including the previously completed well COE-1. Using the newly completed wells, COE-1 and three existing piezometers, the direction of ground water flow was determined to be from the west to the east/northeast.

More recently, the Army Environmental Hygiene Agency (AEHA) completed a study which suggests that groundwater is flowing south. This conclusion contradicts the EA Engineering and A.D. Little conclusions. The uncertainty in groundwater flow direction needs to be resolved and is a primary goal of this focused RI/FS.



SOURCE: ESE, 1986

DESIGNED	EM.	10/94	DATE
DRAWN	S.P.	10/94	DATE
CHECKED	L.L.	10/94	DATE
APPROVED	DK	10/94	DATE

ENGINEERING TECHNOLOGIES ASSOCIATES, INC.
ENGINEERS • PLANNERS • SURVEYORS
3458 ELLICOTT CENTER DRIVE SUITE 101
ELLICOTT CITY, MARYLAND 21043

Figure No. 2
FORT GEORGE G MEADE LOCATION MAP

SCALE: AS SHOWN | CONTRACT NO.: 92307.010 | DATE: OCT. 13, 1994 | SHEET

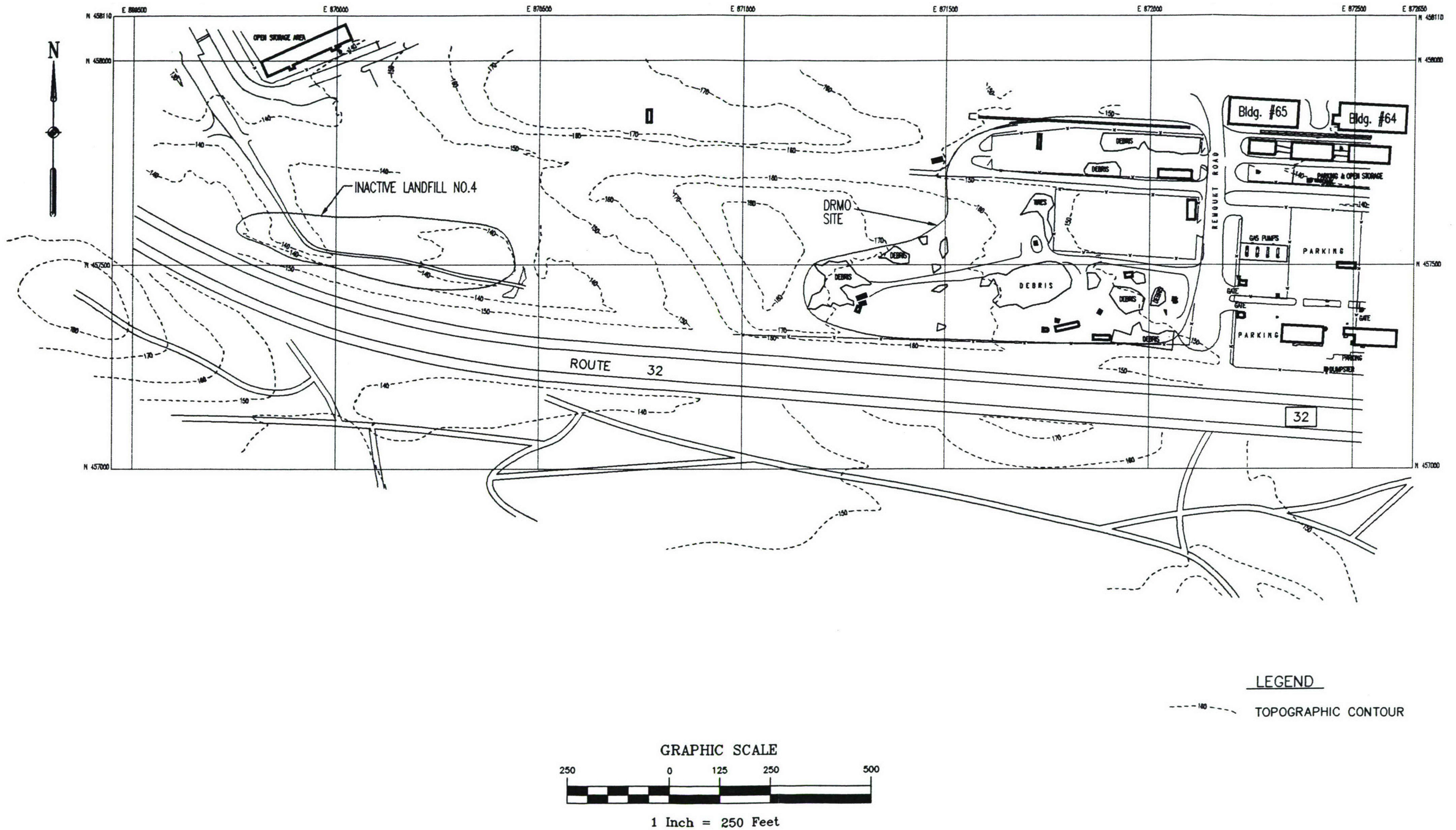


FIGURE NO. 3

DRMO

SITE LOCATION

FORT MEADE, MARYLAND

SCALE: AS SHOWN	CONTRACT NO.: 92307.010	DATE: 05/95	SHEET: 1

ENGINEERING TECHNOLOGIES ASSOCIATES, INC.

ENGINEERS * PLANNERS * SURVEYORS

3458 ELLICOTT CENTER DRIVE SUITE 101
ELLICOTT CITY, MARYLAND 21043
BALTO. 461-9920 WASH. 621-4680

DESIGNED	K.W.	5/95 DATE
DRAWN	S.P.	5/95 DATE
CHECKED	K.W.	5/95 DATE
APPROVED	D.K.	5/95 DATE

2.3 Site Description

2.3.1 Physiography and Surface Water

Fort Meade is located on the western edge of the Atlantic Coastal Plain physiographic province, which is distinguished by its low rolling uplands and low-gradient streams. The Coastal Plain is composed of a wedge of unconsolidated sands, silts, and clays which thicken towards the southeast. Elevations within the base range from 65 to 300 feet above sea level (A.D. Little, 1993).

Fort Meade is located in the Patuxent River watershed. The topographic and physiographic features of the installation are shown on Figure 4. The Little Patuxent River flows southeast throughout the base, and comes within one mile of the DRMO Yard. One tributary of the Little Patuxent flows through Fort Meade. The Rogue Harbor Branch flows southeast through the base approximately one-half mile east of the salvage yard. The Rogue Harbor Branch is fed by two smaller tributaries, the Midway and Franklin Branches. Both branches are located one-half mile to the northeast of the salvage yard. Many small unnamed tributaries flow within the base. The Little Patuxent flows into the Patuxent River, which empties into the Chesapeake Bay.

Two lakes can be found at Fort Meade: Burba Lake is located on the Franklin Branch and Allen Lake is found on the Rogue Harbor Branch. Burba Lake is approximately one mile to the northeast of the salvage yard, while Allen Lake is roughly one mile to the east of the salvage yard.

2.3.2 Surficial and Bedrock Geology

The Coastal Plain Province is distinguished by a wedge of unconsolidated coastal sediments which thicken and dip to the southeast. These sediments were deposited from the Cretaceous to the Quaternary periods.

The sediment layers which are found at Ft. Meade comprise the Potomac Group. At Fort Meade the Potomac Group is approximately 700 feet thick, and consists of the Patapsco, Arundel, and Patuxent Formations (A.D. Little, 1993). These formations are comprised of interbedded sands, silts and clays (Figure 5).

The upper section of the Patapsco Formation contains medium and silty sands which range in color from yellow brown to gray. This section is not present at the DRMO Yard. The middle portion of the Patapsco Formation consists of a thick, hard, mottled clay. This layer has an average thickness of 50 feet. The lower section of the Patapsco Formation is composed of a fine silty sand which coarsens downward to coarse medium sand. Regional thicknesses range from 80 to 100 feet (A.D. Little, 1993).

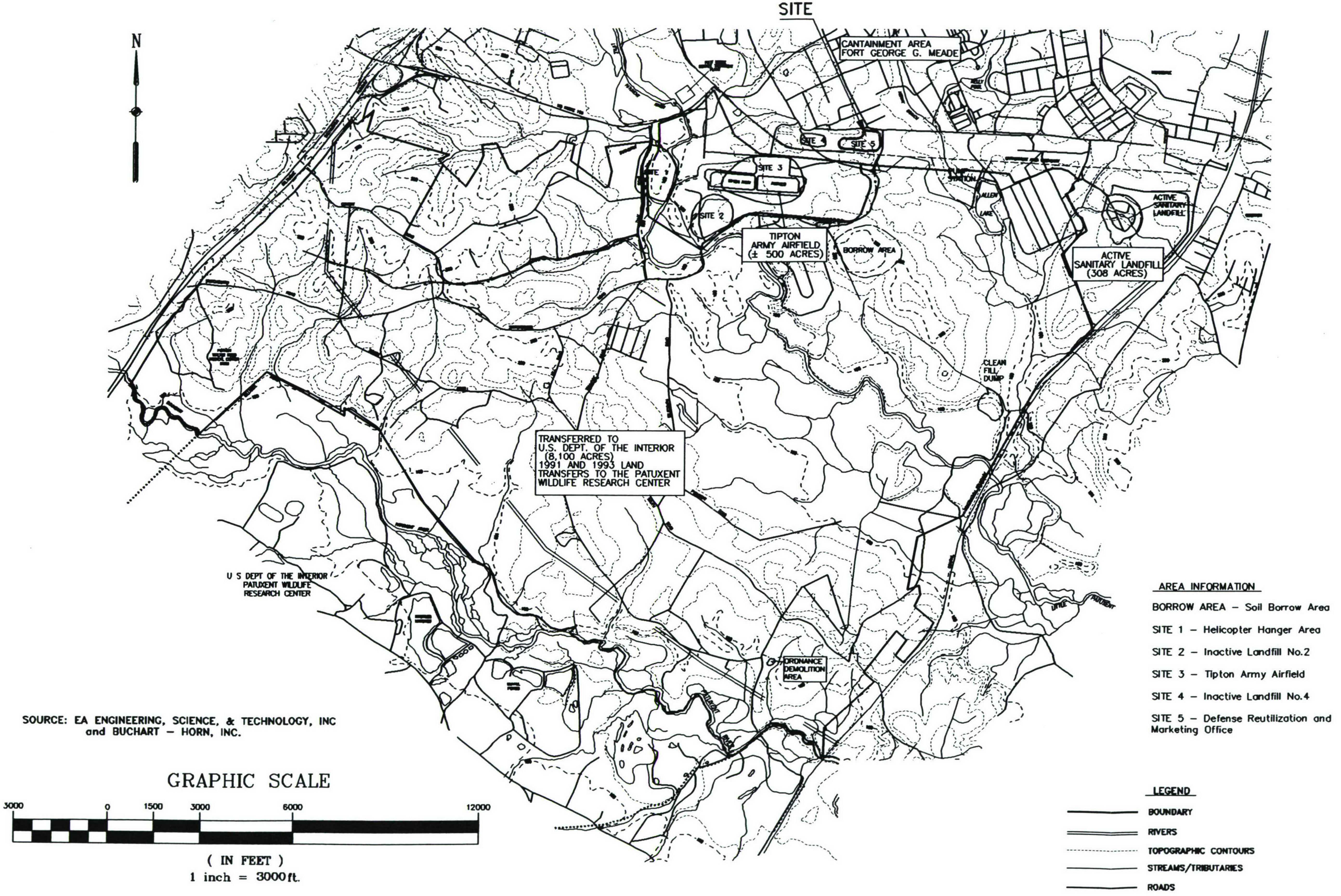


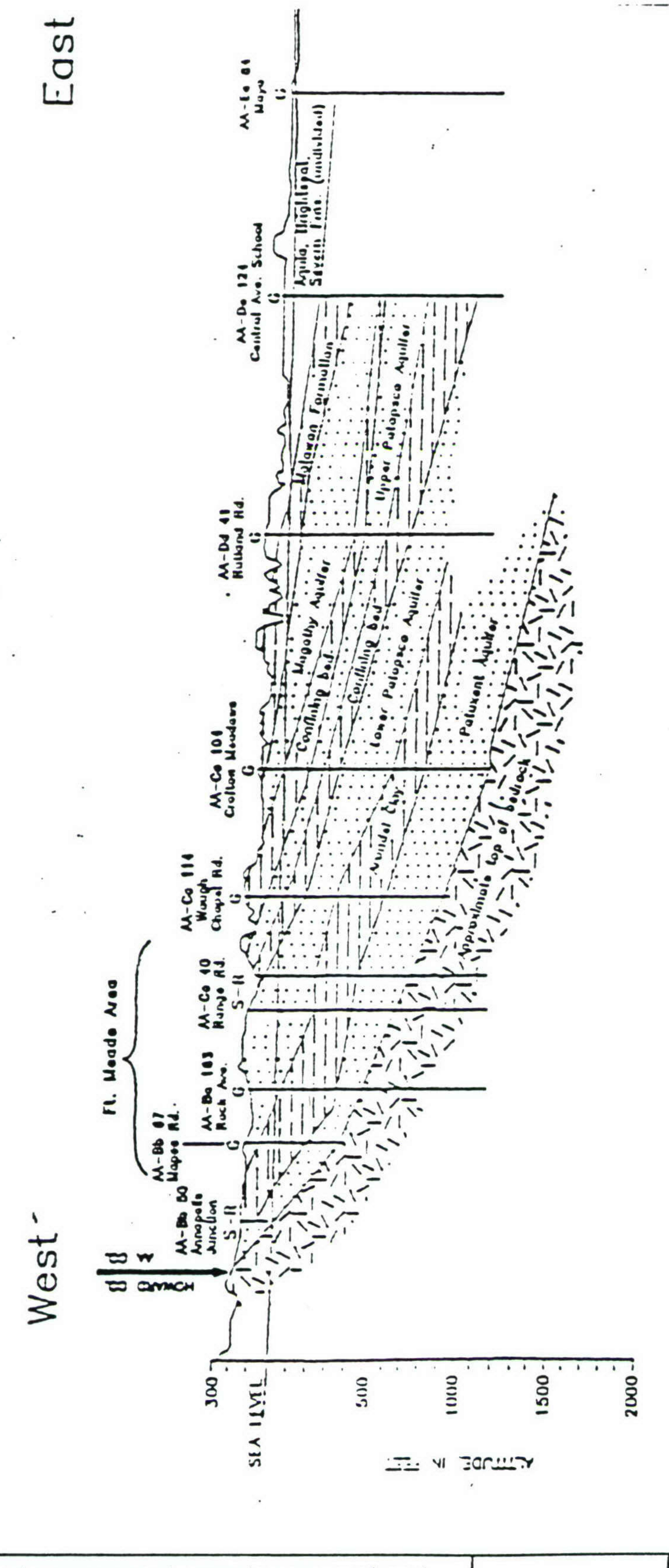
Figure # 4

FORT GEORGE G. MEADE
TOPOGRAPHIC & PHYSIOGRAPHIC MAP

SCALE: AS SHOWN	CONTRACT NO.: 92307.010	DATE: MAY 1995	SHEET: 1

ENGINEERING TECHNOLOGIES ASSOCIATES, INC.
ENGINEERS * PLANNERS * SURVEYORS
3458 ELLICOTT CENTER DRIVE SUITE 101
ELLICOTT CITY, MARYLAND 21043
BALTO. 461-9920 WASH. 621-4490

DESIGNED	C. J. C.	12/94	DATE
DRAWN	S. G. P.	05/95	DATE
CHECKED	K. K. W.	12/94	DATE
APPROVED	L. L. M.	12/94	DATE



Source: A.D. Little 1983

	ENGINEERING TECHNOLOGIES ASSOCIATES, INC. ENGINEERS • PLANNERS • SURVEYORS 3400 ELLICOTT CENTER DRIVE SUITE 101 ELLICOTT CITY, MARYLAND 21043	Figure 5 Hydrogeologic Cross Section Anne Arundel County

The Arundel Formation contains massive beds of red, brown, and gray clay with varying permeabilities. This layer is reported to have a thickness of 250 feet in the Fort Meade area (A.D. Little, 1993).

The Patuxent Formation is comprised mostly of sand and gravel, with some clay and silt layers. This layer is the oldest within the Potomac Group, and rests above the crystalline bedrock. The crystalline bedrock of this region is Precambrian to Cambrian in age, and is composed of igneous and metamorphic rocks. The depth to the bedrock in this area is unknown (A.D. Little, 1993).

2.3.3 Hydrogeology

Within the Potomac Group there are three separate aquifers. They are known locally as the upper and lower Patapsco, and the Patuxent Aquifers. Two clay-rich confining layers can be found between these aquifers. The middle Patapsco confining layer separates the upper and lower Patapsco Aquifers, while the Arundel Formation separates the Patuxent Aquifer from the lower Patapsco Aquifer. Figure 6 is a stratigraphic section of Anne Arundel county, showing the thickness and depths of the various formations and aquifers. On a regional scale these aquifers are confined, but locally they become water table aquifers at their outcrop areas. Both the upper and lower Patapsco Aquifers can be found at Fort Meade. Beneath the Patuxent Aquifer lies bedrock which is considered to have a low hydraulic conductivity (A.D.Little, 1993).

The DRMO Yard is found within the outcrop of the lower Patapsco Aquifer. This sandy layer of the Patapsco acts as a water table aquifer at the DRMO Yard. All monitoring wells in this area are screened within this aquifer. Hydraulic conductivities within the unconfined portion of the aquifer range from 8.1E-4 to 1.1E-3 cm/sec (EA Engineeringr, 1992). Within the confined portion, the hydraulic conductivities varied from 4E-4 to 2E-3 cm/sec (A.D.Little, 1993). The regional groundwater flow of the lower Patapsco is to the southeast, which is consistent with the dip direction of the Formations. Within the DRMO Yard site groundwater flow was found to generally be in a north to northeast direction by both EA Engineering, Science, and Technology, 1992 and A.D. Little, 1994.

2.3.4 Water Use

Both the lower Patapsco and Patuxent Aquifers are used as water supply for residential and commercial purposes. During a survey conducted for the 1992 SI (EA Engineering, 1992), 39 wells were located within a 3-mile radius of the DRMO Yard. These data however only include wells installed since 1969. The majority of these wells are screened in the lower Patapsco Aquifer. The Fort Meade potable water wells are screened in the Patuxent Formation.

Fort Meade uses ground water for potable purposes and has six wells within 8,000 feet of the site. The closest is in Building 61-A approximately 1,200 feet northeast of the site.

Figure 6

Stratigraphic Cross Section of Anne Arundel County

System	Series	Group	Formation	Average Thickness	Hydrologic Character	General Lithology
QUATERNARY	HOLOCENE and PLEISTOCENE		Alluvium and terrace deposits	30	Confining bed in most places. Poor aquifer in some places.	Sand, gravel, silt, and clay.
TERTIARY	EOCENE	PAMUNKEY	Nanjemoy Formation	80	Confining Bed	Sand, with clayey layers, glauconitic.
			Marlboro Clay	30	Confining bed.	Clay, plastic, pale-red to silvery gray.
	PALEOCENE		Aquia Formation	100	Aquifer	Glauconitic, greenish to brown sand with indurated or "rock" layers in middle and basal parts.
			Brightseat Formation	40	Confining bed in most places. Poor aquifer in some places.	Sand, silt, and clay, olive gray to black, glauconitic.
CRETACEOUS	UPPER		Severn Formation	90	Poor aquifer in places.	Sand, silty to fine, with some glauconite.
			Matawan Formation	30	Confining bed	Silt and fine sand, clayey, dark gray to black, glauconitic.
	CRETACEOUS		Magothy Formation	100	Aquifer	Sand, light gray to white, with inter-bedded thin layers of organic black clay.
	LOWER CRETACEOUS	POTOMAC	Upper Part	250	Confining bed	Clay, tough, variegated color.
					Aquifer	Sand, fine to medium, brown color.
			Lower Part	250	Confining bed	Clay, tough, variegated color.
					Aquifer	Sand, fine to medium, brown color.
			Arundel Clay	250 (?)	Confining bed	Clay, red, brown, and gray, contains some ironstone nodules and plant remains.
			Patuxent Formation	250 (?)	Aquifer ? Confining Bed Aquifer ?	Sand, gray and yellow, with interbedded clay; kaolinized feldspar and lignite common. Locally clay layers predominate.
LOWER PALEOZOIC (?) to PRECAMBRIAN (?)			Basement[1] Complex	Unknown	Confining bed	Probably gneiss, granite, gabbro, meta-gabbro, quartz diorite and granitized schist.

NOTE: Consolidated red shaly rocks of Triassic(?) age were drilled at Sandy Point State Park.

Source: Mack and Achmad. 1986. *Evaluation of the Water-Supply Potential of Aquifers in the Potomac Group of Anne Arundel County, Maryland.* Maryland Geological Survey, Report of Investigations No. 46.

Source: A.D. Little, 1993

3.0 INITIAL EVALUATION

3.1 Area Characterization

The DRMO Yard is located north of Route 32 and west of Remount Road and is used as a storage area for various equipment, vehicles, electrical transformers, electronic equipment, heating and cooling units, pipes, dumpsters, and scrap metal. During the site reconnaissance ETA representatives observed a large amount of metal debris on the surface along with electrical transformers.

EA Engineering completed a Site Inspection (SI) of the DRMO Yard in 1992. This investigation included the installation of three shallow monitoring wells, collection of one surface soil and four ground water samples, and determination of ground water flow direction. Previous sampling locations are shown on Figure 7.

During the SI monitoring wells MW-42, MW-43S and MW-43D were completed to depths of 45.0, 40.0, and 92.5 feet respectively. MW-42 was cased from 2.49 feet above ground to 35 feet below the surface and screened between 35.0 and 45.0 feet and MW-43S was cased from 2.31 feet above the ground to 30 feet below the surface and screened between 30.0 and 40.0 feet, both in the lower Patapsco Formation. MW-43D was cased from 2.39 feet above the ground to 82.0 feet below the surface and screened between 82.0 and 92.0 feet deep in the Patapsco Aquifer (EA, 1992).

Arthur D. Little completed a Site Inspection Addendum (SIA) in 1994. During this study the following occurred: installation of two shallow monitoring wells with down-hole UXO surveys, collection and analysis of six ground water samples and collection of six surface soil samples.

Monitoring wells MW-200 and MW-201 were installed as shallow wells. MW-200 was completed to a depth of 60.0 feet and screened from 47.0 to 57.0 feet. MW-201 was completed to a depth of 39.0 feet and screened from 26.0 to 36.0 feet.

3.1.1 Nature and Extent of Contamination

Analysis of ground water samples collected during the SI showed both volatile organic and metals contamination above regulatory action levels.

Volatile contaminants detected included perchloroethene (PCE) and 1,1,1-trichloroethane (TCA). These contaminants were detected in wells MW-42 and MW-43S, both located along the southern boundary of the site. Only PCE was detected above the regulatory action level (5 ug/L) at 50 ug/L. The Maximum Contaminant Level (MCL) for PCE is 5 ug/L and 200 ug/L for TCA. No volatile contaminants were detected in MW-43D which is also located along the southern boundary.

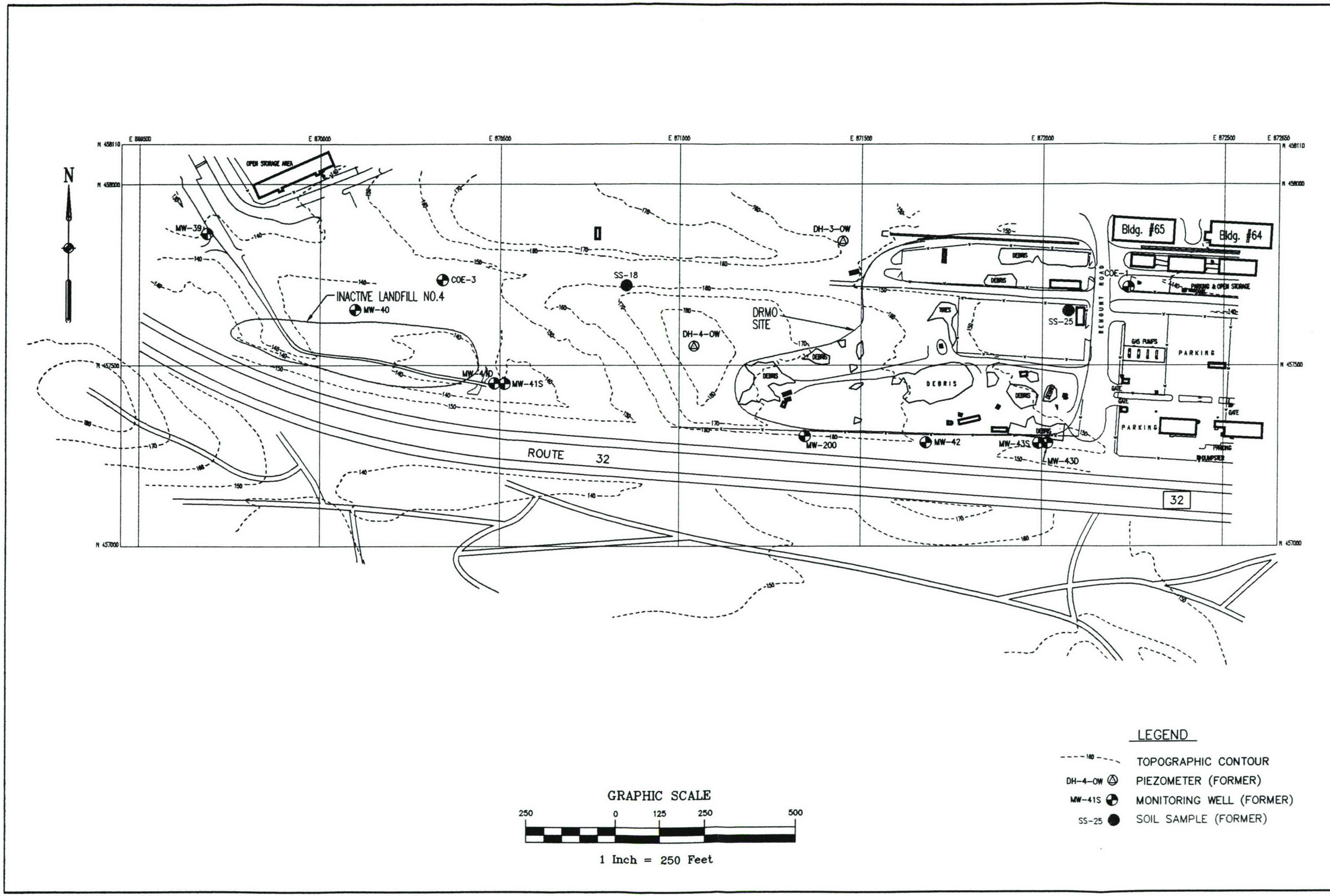


FIGURE NO. 7

DRMO

SITE AND FORMER SAMPLING LOCATIONS

FORT MEADE, MARYLAND

SCALE: AS SHOWN | CONTRACT NO.: 92307.010 | DATE: 05/95 | SHEET: 1

ENGINEERING TECHNOLOGIES ASSOCIATES, INC.

ENGINEERS * PLANNERS * SURVEYORS

3458 ELLICOTT CENTER DRIVE SUITE 101
ELLICOTT CITY, MARYLAND 21043
BALTO. 461-9920 WASH. 621-4680

DESIGNED	K.W.	5/95
DRAWN	S.P.	5/95
CHECKED	K.W.	5/95
APPROVED	D.K.	5/95

The semivolatile compound bis(2-ethylhexyl)phthalate was only detected in MW-43D, and was considered to be potential laboratory contamination.

Total metals detected were below the MCLs except for lead and chromium. Both lead and chromium were detected in samples from COE-1. Lead was detected at 94.30 ug/L and chromium at 155.0 ug/L (A.D.Little, 1993). In MW-42, chromium was also detected at 170.0 ug/L(A.D.Little,1993). The MCL criterion for lead is 15 ug/L and 100 ug/L for chromium. All dissolved metals were below regulatory action limits.

Pesticides and PCBs were also analyzed for. Heptachlor was detected in COE-1 0.003 ug/L and dieldrin and isodrin were detected in MW-43D at 0.027 and 0.005 ug/L respectively(A.D.Little,1993). The MCL for heptachlor is 0.40 ug/L. Dieldrin and isodrin have no MCL and no PCBs were detected.

Analysis of ground water samples collected during the SIA, from newly installed and existing monitoring wells, showed the following VOCs: PCE, TCA, 1,1 dichloroethene (DCE), Freon 11 with the highest concentrations in samples from MW-200 and MW-42. Metals were detected in all samples, with the highest concentrations detected in samples collected from MW-200, MW-43D and MW-43S.

When comparing the analytical data from the two investigations it should be noted that 20 concentrations exceeded their previous maximums and three concentrations were lower. Significant increases of chromium were detected in MW-42; while aluminum and magnesium increased in MW-43S and MW-43D. All other analytes appear to have slightly decreased. Levels of contamination from previous investigations are shown in Table 1.

Table Number 1
Defense Reutilization and Marketing Office
Previous Sampling Data

Volatiles and Semivolatiles

Parameter	MCL	COE-1		MW-42		MW-43D		MW-43S		MW-200		MW-201	
		1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	1992	MAR 1993
VOLATILES										NA		NA	
1,1,1-Trichloroethane(TCA)	200	--	--	20.6	34	--	--	3.33	--		22		--
1,1-Dichloroethene	7	NA	--	NA	12 *	NA	--	NA	--		--		--
Chloroform	100	NA	--	NA	--	NA	--	NA	--		--		1.6
Carbon Tetrachloride	5	NA	--	NA	--	NA	--	NA	1.7		--		1.5
Trichloroflouromethane	---	NA	--	NA	--	NA	--	NA	--		--		--
Tetrachloroethene(PCE)	5	--	--	50.90 *	49 *	--	--	2.31	2.7		150 *		4.9
SEMIVOLATILES										NA		NA	
Bis(2-ethylhexyl)phthalate	---	--	--	--	--	19.10	--	--	--		--		--
Bromacil		NA	--	NA	--	NA	--	NA	4.4		--		8
PESTICIDES			NA		NA		NA		NA	NA	NA	NA	NA
Dieldrin	---	--		--		0.027		--					
Heptachlor	0.40	0.003		--		--		--					
Isodrin	---	--		--		0.005		--					

Units for all reported values: ug/L
--- No MCL
NA Not analyzed
-- None Detected
* Analytes present above primary standards(MCL's)
Sources: (EA, 1992; ADL, 1993)

Table Number 1 (continued)
Defense Reutilization and Marketing Office
Previous Sampling Data
Total Metals

Parameter	MCL	COE-1		MW-42		MW-43D		MW-43S		MW-200	MW-201
		Sample ID									
		1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	FEB 1993	MAR 1993
Aluminum	---	49,700 *	2,240	16,000	12,300	239.0	249	13800	18,100	1,430	5,810
Antimony	6	<60.00	NA	<60.00	NA	<60.00	NA	<60.00	NA	NA	NA
Arsenic	50	<2.35	--	<2.35	4.35	<2.35	7.78	6.95	3.98	--	3.98
Barium	2,000	277.0	94	168	193	264.0	238	146.0	110	107	110
Beryllium	4	3.79	--	1.75	--	<1.12	--	2.33	--	--	--
Boron	---	NA	--	NA	457	NA	--	NA	--	267	--
Cadmium	5	<6.78	NA	<6.78	NA	<6.78	NA	<6.78	NA	NA	NA
Calcium	---	16,400	12,300	17,700	28,200	49,900	32,700	28,200	12,700	19,100	12,700
Chromium	100	155 *	--	170 *	254 *	29.90	--	51.10	18.2	--	18.2
Cobalt	---	<25.00	NA	<25.00	NA	<25.00	NA	<25.00	NA	NA	NA
Copper	1,300	280	21.8	78.4	58.5	<18.80	--	90.40	--	37.4	--
Iron	---	109,000	9,130	40,600	34,800	311.0	203	33,200	5,010	3,530	5,010
Lead	15	94.3 *	--	7.99	11.7	<4.47	--	14.90	--	--	--
Magnesium	---	5,930	4,040	7,420	12,100	1,750.0	7,690	10,600	7,050	5,180	7,050
Manganese	---	134	60.1	149	158	16.4	179	432.0	158	112	158
Mercury	2	0.13	--	<0.100	--	<0.100	--	<0.100	--	--	--
Nickel	100	<32.10	NA	<32.10	NA	<32.10	NA	<32.10	NA	NA	NA
Potassium	---	9,410	3,410	5,080	5,620	110,000	15,200	4,400	4,290	5,700	4,290
Selenium	50	<2.53	NA	<2.53	NA	<2.53	NA	<2.53	NA	NA	NA
Silver	---	<0.33	NA	<0.33	NA	<0.33	NA	<0.33	NA	NA	NA
Sodium	---	47,800	17,600	9,330	10,100	120,000	75,000	98,000	19,600	8,560	19,600
Thallium	2	<125.0	NA	<125.0	NA	<125.0	NA	<125.0	NA	NA	NA
Vanadium	---	211	--	82.90	65.6	<27.60	--	68.80	--	--	--
Zinc	---	138	67.5	105	127	50.90	38.3	238.0	286	39.7	286

Units for all reported values: ug/L

--- No NPDWR exists for Compound
NA Not Analyzed
-- None Detected
* Analytes present above standards (MCL)
Sources: (EA, 1992; ADL, 1993)

Table Number 1 (continued)
Defense Reutilization and Marketing Office
Previous Sampling Data
Dissolved Metals

Parameter	MCL	COE-1		MW-42		MW-43D		MW-43S		MW-200	MW-201
		1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	1992	FEB 1993	FEB 1993	MAR 1993
Aluminum	---	472.0	136	<112.0	197	<112.0	--	2630.0	1460	--	139
Antimony	6	<60.00	NA	<60.00	NA	<60.00	NA	<60.00	NA	NA	NA
Arsenic	50	<2.35	--	<2.35	--	<2.35	--	<2.35	--	--	--
Barium	2,000	86.50	83.4	93.70	104	234.0	216	108.0	106	105	49.4
Beryllium	4	<1.12	--	<1.12	--	<1.12	--	1.17	--	--	--
Boron	---	NA	--	NA	410	NA	--	NA	367	296	--
Cadmium	5	<6.78	NA	<6.78	NA	<6.78	NA	<6.78	NA	NA	NA
Calcium	---	16,000	11,900	14,900	27,100	41,700	30,000	29,000	25,500	25,100	12,900
Chromium	100	<16.80	--	35.20	98.1	27.90	19.1	<16.80	--	--	--
Cobalt	---	<25.00	NA	<25.00	NA	<25.00	NA	<25.00	NA	NA	NA
Copper	1,300	<16.80	--	<16.80	--	<16.80	--	<16.80	--	--	--
Iron	---	<77.50	286	685.0	99.9	<77.50	84.4	<77.50	180	118	--
Lead	15	<4.47	--	<4.47	--	<4.47	--	<4.47	--	--	--
Magnesium	---	4,350.0	4,090	6,420.0	10,900	<135.0	6,920	10,200	11,300	5,710	6,910
Manganese	---	75.60	60.8	116.0	131	<9.67	67.3	407.0	290	104	134
Mercury	2	<0.100	--	<0.100	--	<0.100	--	<0.100	--	--	--
Nickel	100	<32.10	NA	<32.10	NA	<32.10	NA	<32.10	NA	NA	NA
Potassium	---	2,800.0	2,570	3,270.0	4,030	113,000	13,900	3,230.0	3,780	6,550	3,530
Selenium	50	<2.53	NA	<2.53	NA	<2.53	NA	<2.53	NA	NA	NA
Silver	---	<0.33	NA	<0.33	NA	<0.33	NA	<0.33	NA	NA	NA
Sodium	---	48,000	19,400	9,310.0	9,850	120,000	71,000	110,000	90,000	9,710	20,100
Thallium	2	<125.0	NA	<125.0	NA	<125.0	NA	<125.0	NA	NA	NA
Vanadium	---	<27.60	--	<27.60	--	<27.60	--	<27.60	--	--	--
Zinc	---	81.30	71.4	76.40	105	<18.00	25.7	222.0	316	41.2	186

Units for all reported values: ug/L

--- No NPDWR exists for Compound
NA Not Analyzed
-- None Detected
* Analytes present above standards (MCL)
Sources: (EA, 1992; ADL, 1993)

4.0 WORK PLAN OBJECTIVES, RATIONALE AND TECHNICAL SCOPE OF WORK

4.1 Study Objectives

This section summarizes the objectives and work efforts necessary to complete the objective of the task. The components of the investigation include remedial investigation (RI), feasibility study (FS), proposed plan (PP), and record of decision (ROD).

4.1.1 Remedial Investigation

The overall purpose of the RI is to determine if ground water or surface runoff is migrating from the DRMO Yard to the BRAC Land Parcel to the south across State Route 32; and further to determine if either of these pathways is transporting contamination.

The DRMO Yard lies in a topographic high area just north of State Route 32, ground water beneath the site may be migrating to the south, beneath the highway and beneath the BRAC Land Parcel. This is of concern because the BRAC Land Parcel has been transferred to the Department of the Interior/Patuxent Environmental Science Center under the Base Realignment and Closure Act.

Information accumulated during the process of this investigation will be used to conduct a risk assessment and to direct the FS, the PP, and the ROD.

4.1.2 Feasibility Study

If a review of data indicates that migration of contamination via either the ground water pathway or surface runoff is occurring from the DRMO Yard to the BRAC Land Parcel, then a feasibility study will be undertaken.

The purpose of the FS is to evaluate the applicability of various remedial technologies to determine whether they are appropriate remedies for the DRMO Yard. During the evaluation each remedy will be examined to determine its effectiveness, implementability and costs. Tasks required to complete the FS include:

- Development and screening of alternatives
- Detailed analysis of alternatives

4.1.3 Proposed Plan and Record of Decision

The purpose of the proposed plan (PP) is to involve the public in the decision-making process in selecting the remedial alternative. To accomplish this, the PP summarizes the FS, selects the preferred remedial alternative and seeks input from the public.

The ROD has three parts: the declaration, the decision summary, and the responsiveness summary. The ROD documents the remedial action plan for the site. The declaration legally certifies the choice of remedial actions that was selected in accordance with CERCLA and the NCP, outlines the selected remedy and provides public information about the site history, characteristics and risks, and outlines the remedy selection process including other alternatives that were considered.

The decision document supplies the necessary information to support the declaration. The decision summary should include site history, contamination, analysis leading to the final remedy and regulatory requirements.

Public comments will be incorporated into the ROD in the responsiveness summary. The summary should include a discussion of the public's preferences and how they were included in the decision process. The U.S. Army's response to the public's comments will also be contained therein.

4.2 Sampling Objectives and Technical Scope

The purpose of the RI is to determine if either contaminated ground or surface runoff is migrating south toward the BRAC Land Parcel. To confirm or refute this potential migration the following will be accomplished:

- UXO screening of well locations
- Installation of ~~two~~ 8 ground water monitoring wells
- Soil sampling during well completion
- Surveying of wells
- Ground water sampling and analyses

Surface Soil

- Surface runoff and sediment sampling and analyses
- Limited risk assessment (human health and ecological)

Proposed sample locations, frequency, parameters, and the number of QC samples are shown in Table 2.

4.3 Non-Site Specific Samples

As part of the investigation, a number of non-site specific samples will be collected. These samples will be collected for a number of reasons including:

Table 2 DRMO Analytical Program

AQUEOUS SAMPLES	LOC	FREQ	TCL SVOCs	TCL VOCs	TAL METALS	PCB	PEST	SO2	CYANIDE	Hg	TOC
GROUND WATER SAMPLES											
DRMO-Existing Wells	5	1	5	5	5	5	5	0	5	5	5
DRMO-New Wells	8	1	8	8	8	8	8	0	8	8	0
DRMO-Potable Water Well	1	1	1	1	1	1	1	0	1	1	0
Surface Runoff Samples	4	1	4	4	4	4	4	0	4	4	0
TOTAL AQUEOUS SAMPLES			**18**	18	**18**	18	18	0	18	18	0
Quality Control Samples											
Rinsate Blank	1	1	1	1	1	1	1	0	1	1	0
Trip Blank	1	2	0	2	0	0	0	0	0	0	0
Duplicate	2	1	2	2	2	2	2	0	2	2	0
TOTAL AQUEOUS QC SAMPLES			**3**	5	**3**	3	3	0	3	3	0
GRAND TOTAL AQUEOUS SAMPLES			**21**	23	**21**	21	21	0	21	21	0

SOIL/SOLID SAMPLES	**LOC**	**FREQ**	**TCL SVOCs**	**TCL VOCs**	**TAL METALS**	**PCB**	**PEST**	**SO2**	**CYANIDE**	**Hg**	**TOC**	**TCLP**
DRMO-Subsurface	8	1	8	8	8	8	8	8	8	8	8	1
Surface Soil	10	1	10	10	10	10	10	10	10	10	10	0
Surface Sediment	4	1	4	4	4	4	4	4	4	4	4	0
TOTAL SOIL/SOLID SAMPLES			22	22	22	22	22	22	22	22	22	1
Duplicate	3	1	3	3	3	3	3	3	3	3	3	0
GRAND TOTAL SOIL SAMPLES			25	25	25	25	25	25	25	25	25	**1**

NOTES:
LOC- Locations
FREQ- Frequency
TCL VOC - Target Compound List Volatile Organics
TCL SVOC - Target Compound List Semivolatile Organics
TCLP - Toxicity Characteristic Leachate Procedure

PCB- Polychlorinated biphenyls
PEST- Pesticides
TOC - Total Organic Carbon
TAL - Target Analyte List

Drilling Water Supply: USATHAMA Geotechnical Requirements require that all water used during drilling must be analyzed by a laboratory prior to drilling. Water used for drilling purposes will be drawn from Fort Meade production well #5. ETA will collect and analyze two samples for this purpose.

Investigation Derived Waste: Decontamination and well development waters and soils generated during the investigation will be drummed pending analyses to determine the proper disposal method. The appropriate number of samples will be collected from each new well location to characterize generated waste. All waste deemed to be contaminated will be disposed of in a proper manner.

4.4 Site Specific Samples

Sediment and Surface Runoff Sampling: From a review of the topography and a visual site inspection, the surface runoff pathway appears to have several components. Specifically, there are three major components consisting of the following:

- The northern half of the site appears to drain in a northeasterly direction into the storm water system of the installation. This system appears to outlet into a ditch along Rock Avenue which flows westward toward intermittent tributaries of the Little Patuxent River.

- The southeastern portion of the site drains south into a ditch along State Route 32. Runoff in this ditch is combined with runoff from Route 32 and flows to the east into the Rogue Harbor Branch of the Little Patuxent River. This branch flows under Route 32 and into Allen Lake. This lake lies south of Route 32 on the BRAC Land Parcel.

- The southwestern portion of the site drains into a ditch along Route 32 and after combining with runoff from Route 32 flows westward into an intermittent creek. This creek continues on into the Little Patuxent River.

These three discrete surface runoff pathways could potentially create migratory pathway(s) connecting the DRMO site and the BRAC Land Parcel. Therefore, ETA recommends surface runoff and sediment sampling in the drainage ditches. Four surface runoff and sediment samples will be collected following a storm event to determine whether runoff from the site is contaminated. Both sediment and water samples will be analyzed for the same parameters using the same methods as for the ground water and soil samples.

Soil Samples: Subsurface soil samples will be collected at 5-foot intervals during the installation of the monitoring wells and field screened. One sample from each well will be submitted to the laboratory for chemical analysis. A duplicate of one sample will be included for QC purposes.

Ground water samples: After the the eight new wells have been completed and have been developed, they will be sampled along with five existing wells.

4.5 Quality Field Samples

Quality control samples, including field blanks, duplicates, rinsate blanks and field background samples are included in this task and are shown in Table 2. Laboratory quality control samples are specified in the QCP.

5.0 REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

The RI/FS of the DRMO Yard has been divided into seven Tasks.

5.1 Task 1 - Site Reconnaissance and Data Review

All appropriate background data will be collected from the USAEC, the AEHA library and Fort Meade records. These data will be reviewed and after its completion a site reconnaissance visit will be undertaken.

The site visit should be scheduled within 12 days subsequent to Task award.

5.2 Task 2 - Project Plans

Four plans are required for the successful completion of this project. The Quality Assurance Plan (QAP) will be included in the Technical Work Plan.

5.2.1 Management and Resource Utilization Plan

A Management and Resource Utilization Plan will describe the organization structure and project approach for the accomplishment of each Task. This plan will cover the organization structure, a discussion of program approach for completing each task, the plan of work, time schedule, and a breakdown of the work elements and labor requirements by task. Monthly manpower requirements and allocation of costs will be discussed in this plan. Manpower and resource utilization will be tabulated by month and by task to include ETA and Other Direct Costs (ODCs) and projected over the course and duration of the project.

Monthly and cumulative labor and other direct costs will be projected and presented in tabular form.

5.2.2 Technical Work Plan

The Technical Work Plan (TWP) will describe the nature of the technical portion of the investigation and will focus on field data collection. Procedures for all field and laboratory activities will be discussed in this Plan.

The field effort discussion will include the proposed location of additional monitoring wells and the sampling procedures that will be implemented.

5.2.3 Quality Assurance Plan (QAP)

The QAP will be included in the TWP and will describe the utilization of the appropriate USAEC procedures. It will describe efforts related to the analysis of data once they have been validated. Additional efforts described in the QAP include data evaluation, data reduction and

tabulation, environmental risk assessment, management and quality control.

5.2.4 Health and Safety Plan

A site-specific Health and Safety Plan will be developed and written for the field investigation portion of this RI/FS.

5.2.5 Quality Control Plan

A Quality Control Plan (QCP) for the RI/FS at the DRMO site will be developed to comply with the requirements of the USAEC Quality Assurance Program, USATHAMA PAM 11-41, Revision No. 0, January 1990 and appropriate EPA Region III Quality Assurance Guidance as applicable. Our subcontracted laboratory will be DataChem Laboratories, of Salt Lake City, Utah. They will provide chemical analyses of environmental samples collected during this investigation. The QA Program from DataChem Laboratories will be included in the QCP as Attachment A.

5.3 Task 3 - Project Meetings

ETA staff will attend and participate in meetings at USAEC and Fort Meade. The nature of these meetings will be to accumulate data, to discuss the status of the project or to attend Public Meetings at Fort Meade. Community relations support provided to the USAEC will be completed in this task.

5.4 Task 4 - Remedial Investigation

ETA will conduct a focused RI to determine if contamination is migrating from the DRMO Yard to the BRAC Land Parcel to the south via a hydrologic connection. This Task has been broken down into seven subtasks as follows:

5.4.1 Unexploded Ordnance (UXO) Screening

A review of documentation shows that there is a potential for unexploded ordnance to be encountered during the subsurface investigation. Therefore, the sites selected for placement of the additional wells will be screened in accordance with USAEC procedures, and the site specific Health and Safety Plan.

5.4.2 Monitoring Well Installation and Soil Sampling

5.4.2.1 Introduction

The direction of ground water flow is critical to the objectives of the RI. Furthermore, the ground water elevation measurements in MW-200 have been questionable, resulting in conflicting conclusions regarding ground water flow direction. In order to clarify this situation,

ETA will install eight monitoring wells, to be located as shown in Figure 8. These wells will serve the purpose of verifying whether any contamination is migrating via a ground water route from the DRMO site to the BRAC Land Parcel, and help clarify doubts as to the direction of ground water flow. Based on analytical data, ground water samples from wells MW-42, MW-43S, and MW-200 consistently have elevated levels of contamination. Therefore, these wells are necessary to determine if contamination is contained on site or not. If contamination is not detected in the eight new monitoring wells, these wells could still serve as sentinel wells under a ground water monitoring program.

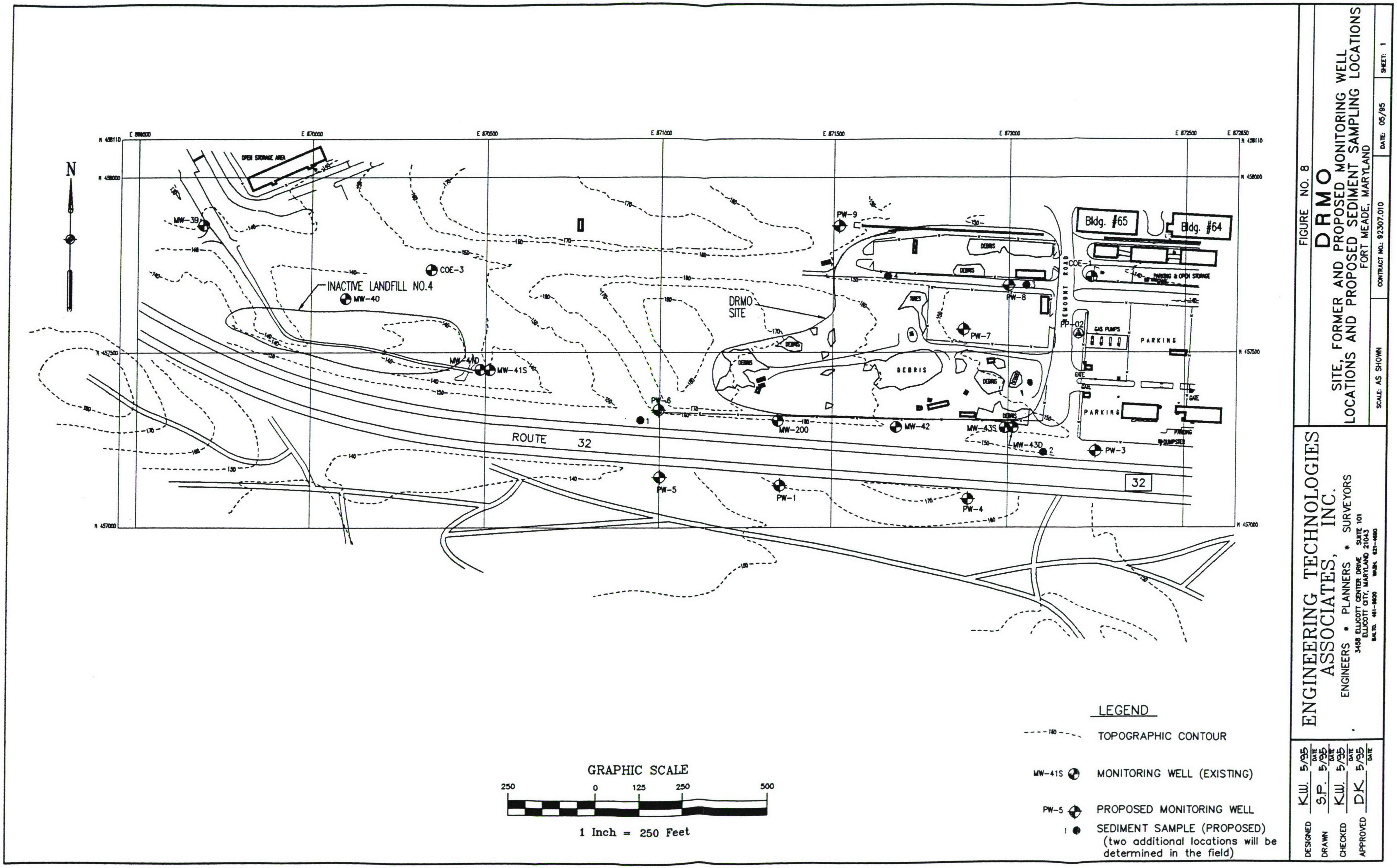
5.4.2.2 Well Installation Procedures

Each well will be drilled and installed by a Maryland licensed driller under the supervision of an ETA geologist who will log the boring and document well completion. All wells will be drilled and installed according to the USAEC geotechnical guidelines (USATHAMA, 1987). Hollow stem augers (6.25 inches inside diameter) will be used to drill 10.5-inch borings at each well location. A 24-inch split spoon will be used to collect soil samples at five-foot intervals and ahead of the augers. The spoon will be driven by a 140-lb hammer and blow counts per six inch penetration of the split spoon will be documented. Upon completion of the borehole to the desired depth, the well will be installed using 4-inch schedule 40 PVC well screen and risers.

Each well will consist of the appropriate length of screen and the appropriate length of riser to allow for a minimum of two feet of stick-up above the surface. To complete the wells, a filter pack of No. 1 Morie Sand, after approval by the AEC project geologist, will be placed around the screen to a depth of at least five feet above the top of the screen. A five-foot bentonite seal will be installed above the sandpack, and the rest of the annular space grouted to the surface using a cement/bentonite grout mixture. Each well head will be protected by a six-inch diameter steel casing with a locking cap. Four protective posts will be installed around each well consisting of a 4-inch steel pipe filled with concrete, and be at least 4 feet from the well (USATHAMA, 1987).

5.4.2.3 Soil Sampling and Field Screening

During well installation, split spoon samples will be collected at 5-foot intervals for analytical and logging purposes. Each sample will be logged for soil type, and placed into two glass jars; one for field screening, and the other for laboratory analysis, if needed. The sample for laboratory analysis will be placed in a glass jar, covered with a teflon-lined screw-on lid, labelled, and placed on ice. The sample for field screening will be placed in a jar half full, and covered with aluminum foil. The sample will be allowed to equilibrate for about 15 minutes. The tip of a Photoionization Detector (PID) will be placed in the headspace above the sample by piercing the foil. The level of organic vapors registering on the PID will be recorded in the field notebook. The sample from each well boring that registers the highest PID reading will be submitted to the lab for analysis. If no organic vapors are detected from any sample, the



N
OPEN STORAGE AREA
MW-39
INACTIVE LANDFILL NO.4
MW-40
COE-3
MW-41D
MW-41S
DRMO SITE
PW-6
MW-200
MW-42
MW-43S
MW-43D
PW-9
PW-8
PW-7
PP-02
COE-1
DEBRIS
TIRES
GAS PUMPS
PARKING
GATE
PARKING & OPEN STORAGE
DUMPSTER
DEMOUNT ROAD
Bldg. #65
Bldg. #64
ROUTE 32
32
PW-5
PW-1
PW-4
PW-3
E 869500
E 870000
E 870500
E 871000
E 871500
E 872000
E 872500
E 872650
N 458110
N 458000
N 457500
N 457000
GRAPHIC SCALE
250
0
125
250
500
1 Inch = 250 Feet
LEGEND
TOPOGRAPHIC CONTOUR
MW-41S MONITORING WELL (EXISTING)
PW-5 PROPOSED MONITORING WELL
1 SEDIMENT SAMPLE (PROPOSED) (two additional locations will be determined in the field)
FIGURE NO. 8
DRMO
SITE, FORMER AND PROPOSED MONITORING WELL LOCATIONS AND PROPOSED SEDIMENT SAMPLING LOCATIONS
FORT MEADE, MARYLAND
SCALE: AS SHOWN
CONTRACT NO.: 92307.010
DATE: 05/95
SHEET: 1
ENGINEERING TECHNOLOGIES ASSOCIATES, INC.
ENGINEERS * PLANNERS * SURVEYORS
3458 ELLICOTT CENTER DRIVE SUITE 101
ELLICOTT CITY, MARYLAND 21043
BALTO. 461-9920 WASH. 621-4880
DESIGNED K.W. 5/95
DRAWN S.P. 5/95
CHECKED K.W. 5/95
APPROVED DK 5/95

sample collected at the water table, will be submitted for analysis. The samples collected for analysis will be labelled, placed on ice, and be delivered to DataChem Laboratories.

5.4.2.4 Surface Runoff and Sediment Sampling and Screening

The following surface runoff and sediment samples will be collected during the RI. Four surface runoff samples will be collected from each of the two ditches to the north and south of the site. Four sediment samples will also be collected. One from the ditch east of the drainage culvert, one from the ditch at the western end of the site and two from the ditch that runs parallel to and on the south of Rock Avenue (Figure 8). During sample collection the media will be screened with a PID. Surface runoff samples will be analyzed for total metals.

5.4.2.5 Decontamination

All drilling equipment will be decontaminated before arrival at the site. While on site, the drill rig, augers, drill rods, and all downhole sampling equipment will be decontaminated between wells. This decontamination will be conducted at a decontamination pad to be constructed on site. The split spoon sampler will be decontaminated between samples. Decontamination of the rig, augers, drill rods, and tools shall consist of steam cleaning followed by a distilled water rinse. Sampling spoon decontamination shall consist of a brush scrub in potable water followed by a distilled water rinse. The spoon will be wrapped in aluminum foil until it is needed. At the end of the well installation program, all drilling equipment and tools will be properly decontaminated before leaving the site. Decontamination waste waters will be drummed and stored on site until analytical results are available to determine proper disposal.

Equipment used to collect surface runoff or sediment samples will be decontaminated before using and prior to being re-used.

Water for well installation and decontamination purposes will be from Fort Meade supply well #5 located off Alt. Range Road in the southeast section of the BRAC Land Parcel. A sample of this water will be analyzed for all previously mentioned analytes and the results reviewed by the USAEC for approval prior to the start of field work.

5.4.2.6 Well Development

Upon installation, and after allowing at least 48 hours but no more than 7 days for stabilization, each well will be developed using the surge and pump method. Using a submersible pump as a surge block, the well will be agitated for several minutes, and then pumped as fast as possible to remove silts. This process is to be repeated until the water runs clear, or the pH stabilizes (USATHAMA, 1987). All development water will be containerized and analyzed before it is properly disposed of.

5.4.3 Surveying

Using North American Datum 1927 (NAD27) horizontal and vertical control and USAEC procedures, ETA will obtain the elevation of the new monitoring wells and MW-200. MW-200 has been added because of the potential for survey error in the existing data.

5.4.4 Water Level Measurements

Subsequent to the completion of the survey, ETA will measure the ground water levels in all monitoring wells and piezometers on site. Water levels will be measured using an electronic measuring device. The probe of the device is lowered into the well until it hits the water. A continuous tone is emitted when the probe contacts water. The depth to water is read off the calibrated tape to which the probe is attached. Water levels will be read with 0.1 foot accuracy.

5.4.5 Aquifer Testing

No aquifer test is planned until the ground water flow direction has been determined. At that time, all available data will be evaluated to determine if an aquifer test is necessary. The type, extent, and duration of the test will be decided at that time.

5.4.6 Ground Water Sampling and Analysis

Ground water samples will be collected from the new and existing monitoring wells for analysis. Prior to collecting the samples the monitoring wells will be purged by removing a minimum of three casing volumes of ground water. The physical parameters of temperature, pH, and conductivity will be measured in the field. Collected samples will be preserved according to EPA protocols, packed on ice and shipped to the laboratory. Additionally, a field duplicate and a rinsate blank will be collected and shipped along with the samples.

5.4.7 Data Analysis

After ground water level data are collected, an analysis of the probable direction of local flow will be made. This data will be combined with data from other sources and entered into a ground water level database for the site. Available water level data from wells within one-half mile of the site will be collected, reviewed and entered into the database. Potential sources of data include:

- Previous studies at Fort Meade
- Previous AEHA studies at Fort Meade
- Underground storage tank wells
- Geotechnical data accumulated during the completion of State Road 32 and
- Other data as available

All data will be plotted and a ground water contour map prepared.

5.5 Task 5 - Feasibility Study

If it can be determined by a review of the analytical data that contamination is migrating via the ground water and (or) the surface runoff to the BRAC Land Parcel from the DRMO site, then a feasibility study will be performed.

The feasibility study will develop and screen potential remedial alternatives and present a detailed analysis of the alternatives to the decision-makers. With input from the public, a decision will be made regarding which remedial alternative to select.

5.6 Task 6 - Final Reporting

During this task ETA will produce the final remedial investigation and feasibility study reports along with preparing a Record of Decision and supplying community relations support.

5.7 Task 7 - Project Management

This task includes general project oversight and the generation of monthly cost and performance reports which will be submitted to the USAEC. A review of the monthly report will allow the Contract Officer's Representative (COR) to track the monthly and cumulative task labor and ODCs.

6.0 CHEMICAL ANALYSIS PROGRAM

6.1 Laboratory Analysis

6.1.1 Coordination of Laboratory, Field, and Data Validation Activities

The coordination of the analytical laboratory with field activities and data management will be accomplished by ETA's and Woodward-Clyde's designated personnel. These personnel will be responsible for planning, tracking, coordinating and documenting all aspects of sampling, analysis and data validation. Specifically, their duties will include:

- Collecting all reports and guidance documents related to sample documentation, analytical procedures, data validation, and QC procedures from USAEC and EPA Region III and distributing them to the appropriate personnel
- Coordinating all sample analysis requests from the Project Manager
- Providing direction for non-routine analyses
- Ensuring proper distribution of sample containers, appropriate preservation of samples, use of chain-of-custody forms and other appropriate sampling and analysis documentation forms by sampling teams
- Ensuring that sample documentation procedures presented in the QCP are followed
- Coordinating the delivery of samples to the subcontracted laboratory
- Reviewing weekly quality control reports
- Receiving all laboratory analytical data
- Ensuring that specified laboratory analytical data are appropriately reviewed using USAEC procedures before they are transmitted to the Project Manager, or his designated representative
- Reporting to the QA Officer regarding data quality and appropriate corrective actions

These duties will be coordinated with the assistance of the Project Manager, Field Activities Supervisor, Quality Assurance Officer and USAEC staff.

6.1.2 Sample Analysis

The analytical program has been designed to provide qualitative and quantitative data consistent with USAEC reporting limits and the requirements of federal and state agencies. The objective

of this sampling program is to collect sufficient samples to accurately define the type and extent of contamination and to determine whether there is a hydrologic connection between the DRMO Yard and the BRAC Land Parcel. DataChem Laboratories, located in Salt Lake City, Utah, has provided analytical support to USAEC in the past and will provide the same level of timely and quality support for this project.

6.1.2.1 Sample Receipt

After DataChem Laboratories receives the samples, they will be inspected by the Sample Receipt Officer. The date and time of receipt, airbill number,sample condition, and cooler temperature will be recorded; and the chain-of-custody signed. Any discrepancies in the documentation and/or physical condition of the samples will be reported immediately to the Lead Chemist, who will notify the USAEC chemist and prime contractor within 24 hours. All samples will be stored properly and scheduled for analyses in accordance with the holding times in the USATHAMA QA Manual.

6.1.2.2 Lot Assignment

According to USAEC quality assurance procedures, the number of samples that can be analyzed by a given method in a single day is designated as a lot. The lot size is determined by the rate-limiting step in the analytical process. Therefore, samples grouped in this manner will be labeled with a USAEC identification three-letter code. Both field and QC samples which are part of lots will be assigned an additional three-digit code (e.g., AAA001, AAA002....etc.) Spiked USAEC soil or water QC samples will be added to each lot. Generally four QC samples are required for each lot; one method blank, one low spike and two high spikes.

Although lot sizes are defined for each certified method, every effort will be made to maximize the lot size without compromising holding times.

6.1.2.3 Standards and Quality Control Samples

Standards and quality control samples will be prepared using Standard Analytical Reference Materials (SARMs) and Interim Reference Materials (IRMs) supplied by USAEC or from standard materials obtained from the EPA or the National Institute of Standards and Technology (NIST). If standard materials from commercial sources are used, they will be characterized using documentation supplied by the vendor and DataChem Laboratories.

All analytical standard working solutions will be prepared by the analyst consistent with the approved analytical method. The analyst will document in a notebook or a standards preparation logbook the preparation methods. If new or replacement standards are received, they will be validated against either the previously used standard, a commercially prepared quantitative standard or a standard prepared by another analyst for validation. A new solution will be considered acceptable if its analytical value is within 5 percent of the theoretical value.

6.1.2.4 Instrument Calibration

DataChem Laboratories analytical instrumentation is calibrated on an "as used" basis by either a preventative maintenance contract or a contract with the manufacturer and will be calibrated in accordance with the USAEC QA Plan. During initial calibration a minimum of one blank and five calibration standards (Class 1 methods) or one blank and three calibration standards (Class 1A and 1B methods) that bracket the certification testing range will be analyzed on a single day. Additionally, Class 1 and 1B methods require the analysis of calibration check standards at the end of the initial calibration. If the results of the calibration check standards are not acceptable, they will be reanalyzed. If reanalyses produce unacceptable results, analysis will be stopped until a successful initial calibration can be achieved. To verify that the instrument response has not changed from the previous calibration, the highest calibration standard will be analyzed. The standard will be reanalyzed if the response is outside the acceptable range. An additional calibration will be performed if the response is still not acceptable. Each day analysis occurs the instruments will be tuned as applicable, and the required number of concentrations of standards will be analyzed with each lot of samples. The appropriate corrective action will be pursued and documented by the analyst if calibration criteria are not met.

6.1.2.5 Analytical Procedures

DataChem Laboratories maintains USAEC performance demonstration for over 60 analytical methods; a complete listing of the methods to be used in this program is provided in the QCP. To the extent possible, only performance demonstrated methods will be used in the analysis of field samples. Only one method, TCLP, does not require USAEC performance demonstration. TCLP will be used only to determine the disposal procedures for investigation derived wastes.

Although the TCLP method is not subject to the USAEC performance demonstration process, EPA or other published methods will be used and all reported values must be supported by calibration and quality control data in accordance with the USAEC QA Plan.

Investigation derived waste samples will be disposed of after analysis using the RCRA Toxicity Characteristic Leaching Procedure (TCLP) as described in Method 1311 of Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.

All quality control and field samples will be analyzed according to the referenced methods. If deviations from the referenced method become necessary due to the nature of an individual sample, the method modification will be approved in advance by the ETA Lead Chemist and will be documented in the analyst's notebook and data package.

DataChem Laboratories will forward a weekly quality control report to the ETA Lead Chemist. This report will include USAEC control charts for all certified analytical methods, a discussion of any out-of-control situations or data trends and any corrective action taken.

All files must be transferred to IRDMIS within 21 days of sample receipt. All data packages will be delivered to WWC, ETA's subcontractor within 60 days of receipt of the last sample. All data packages will include the following:

- Chain of custody forms
- Narrative of any problems noted during the analysis, deviations from the analytical procedure, or limitation on the use of the data
- Data sheets or any other preprinted forms used by the laboratory
- Original chromatograms, strip charts and/or other instrument output
- All hardcopy GC/MS output including expanded scale blow-up of manually integrated peak(s)
- Copies of all relevant notebook pages or standard forms used to record information such as standard preparation, sample preparation/extraction, instrument calibration, instrument operating conditions, percent moisture or any other information relevant to the analytical data
- A copy of the completed Quality Assurance Coordinator (QAC) Checklist

10 percent of the completed packages will be validated by the laboratory and an additional 25 percent will be validated by WWC, the ETA subcontractor. WWC will use EPA Region III validation methodology.

6.1.3 Laboratory Data Management

DataChem Laboratories will enter all sample results into the USAEC Installation Restoration Data Management Information System (IRDMIS). Specific instructions on data format and proper entry can be found in the IRDMIS User's Guide. An analyst will enter the data on a coding form which will be verified by another analyst and group leader. QA personnel will also review data for any obvious errors. Data users will be alerted to any analytical problems or limitations by flagging codes as defined in the IRDMIS User's Guide. The data will be entered into IRDMIS, checked through two USAEC software routines, printed out, and verified by Data Entry Specialists. Verified data will then be submitted to USAEC and ETA. A hardcopy of the IRDMIS data will be included in each data package.

Each lot will have a separate data package. These will be forwarded to the ETA Lead Chemist within 40 days of sample receipt. DataChem will review 10 percent of the packages, and any problems or omissions noted in this review. WWC, ETA's subcontractor will validate an additional 25 percent using EPA Region III validation guidelines. Subsequent to data review, all packages will be forwarded to USAEC.

7.0 QUALITY ASSURANCE, DATA MANAGEMENT, AND DATA EVALUATION

7.1 Quality Assurance

There are four aspects of the DRMO Yard project that will undergo systematic QA reviews: the overall project activities, the field/geotechnical activities, the laboratory analysis activities and the data files and packages. The QA reviews are the responsibility of the ETA QA Officer. The laboratory QA reviews will be undertaken by Woodward Clyde Federal Services under subcontract to ETA. Oversight will be supplied by ETA. These reviews will assure that activities and data are implemented in accordance with this Technical Work Plan and the QCP and associated Standard Operating Procedures, provided as a separate document. These documents adhere to the requirements specified in the USATHAMA QA Program (1990), and the USATHAMA Geotechnical Requirements for Drilling, Monitoring Wells, Data Acquisition and Reports.

7.1.1 Field and Laboratory Quality Assurance Reviews

Through a combination of on-site and off-site document reviews, field QA reviews will be performed. During these reviews the following will be checked to ensure their conformance to the above-referenced documents:

- Field logbooks and forms
- Field chemical/physical analyses including calibration and QC samples
- Containers and sample preservation used for collected samples
- Sample storage and security
- Location and elevation survey
- On-site drill rig steam cleaning procedures prior to drilling activities, between each well, and before leaving the site
- "Dig-safe" and UXO screening procedures
- Confinement and containerizing of drilling wastes (waste steam cleaning condensates from drill rigs and the PVC pipe used for casings; drilling fluid, if used; and surface runoff)
- Drilling activities (water sources used) and well materials (sand, bentonite, and grout)

- Well development and pre-sample purging techniques

- Depth measuring techniques

- Accurate drawings of the well's location and drilling operations

- Collection of specified numbers and types of soil, ground water and surface water samples are collected and sent to the laboratory

Laboratory QA reviews will be undertaken by DataChem Laboratories QA Coordinator. These reviews will include verification that the following meet USAEC requirements:

- Sample log-in and inspection

- QC samples (usually one method blank, one low spike, and two high spikes) and sample lot sizes

- Instrument calibration using SARMs, IRMs, or "off-the shelf" materials characterized by two methods (initial and/or daily calibrations)

- Logs including laboratory notebooks and/or forms (sample log-in, laboratory chain-of-custody forms, instrument usage, calibration, and maintenance notebook/logs, sample preparation notebooks and logs, sample analysis spreadsheets and files, standard solution preparation and identifications, analysis methods notebooks, and, when required, corrective action documentation

- Laboratory water quality (ASTM Type I and Type II)

- Control charts (single day XBAR, range control charts for high spikes, and three-day moving XBAR and Range control charts for low spikes and GC/MS analyses)

- Identification of out-of-control systems and corrective action procedures

ETA will provide QA oversight through review of laboratory weekly status reports, QC summary reports, control charts, and at least weekly phone calls to the laboratory.

Observations will be noted as to whether approved practices are followed. The Program Manager and Task Manager will receive a formal report composed of summary findings. Any changes in the program or plans be noted and discussed with the staff members, appropriate management, and USAEC as appropriate.

7.1.2 Data Review

The DataChem Laboratories QA Coordinator will review ten percent of all data packages as required by the USAEC QA Plan. The review should serve two purposes; it examines the package content for technical and record keeping errors and ensures that all required data and documentation are provided. Along with the notation of any corrective action, the reviewers name and date of review will be recorded.

DataChem Laboratories will provide to WWC, ETA's subcontractor, all data packages. WWC will validate an additional 25 percent of the data using EPA Region III validation guidelines. The packages chosen for review will have as broad a range of analyses and matrices as possible. The Lead Chemist will assess the completeness of the documentation provided, adherence to the certified or other published method, adherence to USAEC quality control requirements, and acceptability of the quality control data. The Lead Chemist will also perform a technical review of the data. This review will include verifying at least one calculation for standard preparation and final reported analyte values from the raw data contained in the data packages to the final reported value in IRDMIS. If discrepancies or omissions are uncovered, they will be discussed promptly with DataChem Laboratories. A copy of ETA's Lead Chemist review will be added to the data package.

DataChem Laboratories will record-check IRDMIS files to ensure that the analysis was performed correctly and within the sample holding times specified. Then the samples will be group-checked to confirm that the proper number of control samples were analyzed and each sample site corresponds to a valid map site. After successful record and group checks, data may be transferred to PRI who manages the IRDMIS.

7.2 Sample Tracking and Data Management

7.2.1 Sample Tracking

So that individual samples can be linked to a particular location, depth, time and sample medium prior to interpretation, each sample will be assigned a unique sample designation during the performance of this RI. These designations will be composed of a predetermined Site Location Identity (SLI) and a Unique Sample Code (USC). The SLI is composed of an alphanumeric code that includes the IRDMIS Site ID, Site Type and Media Code. The USC indicates additional information regarding area identification, sample interval and sample media. All previously established sample locations that are scheduled for resampling during this project will use the previously designated Site ID to maintain consistency in the IRDMIS. All new sample locations will be assigned Site IDs consistent with those already in existence.

After sample labels are produced and attached to the appropriate sample container, they will be grouped by sample and distributed to the appropriate field teams for sample collection. As the samples containers return from the field, information from the labels will be logged into a field notebook.

7.2.2 Data Reduction/Evaluation

Information produced by this task will be used to perform the limited risk assessment and the FS. The raw field data will be reduced and organized into the IRDMIS format, and will consist of the following:

- Information gathered during the water supply survey will be plotted on a map to illustrate where ground water is used for domestic purposes.

- A detailed map of the DRMO Yard will be prepared including, areas of concern, sampling locations and ground water elevation data. Ground water contour maps will be constructed for each aquifer investigated.

- For the risk assessment all IRDMIS Level III chemical data will be compiled in site- and media-specific tables. The data will also be summarized in additional tables that will include, for each medium at each site, the range of concentrations, arithmetic mean concentration, and upper 95 percent confidence limit of the mean. These tables will be used in preparation of the RI and FS.

- The chemical concentrations will be plotted onto flow maps so that source areas and directions of contaminant migration can be evaluated.

- The results of the exploratory boring and soil sampling program will be used to develop a series of stratigraphic cross-sections beneath the site. The various geologic descriptions will be used to correlate the various stratigraphic units identified so that a three-dimensional understanding of the unconsolidated sediments can be attained.

- The results of soil field screening readings will be plotted on the geologic cross-sections. Contaminant concentration contours, in cross-section, for each identified family of chemicals will be developed to evaluate the vertical chemical profile with the unsaturated zone.

- The chemical results of the ground water sampling will be added to the geologic cross-sections along with water data that correspond to that particular sampling event. These data will be used in conjunction with the hydraulic data to evaluate the historical and future migration of contaminants.

- The lateral distribution of various contaminants with ground water will be contoured for the DRMO Yard. These maps will provide the basis for all sampling data, and provide precise vertical elevations and hydraulic elevation measurements.

The reduced data will then be used to form a surface and subsurface chemical analyses database which will assist in completion of the risk assessment and feasibility study.

7.2.3 IRDMIS Database Management

Upon completion of the proposed monitoring wells and water level measurements, ETA will prepare the field data for entry into the Installation Restoration Data Management Information System (IRDMIS) of AEC. The database information will consist of the wells and piezometer construction details, and stabilized ground water level measurements.

7.2.3.1 IRDMIS Data Management

All field data collected will be directly linked to a specific location, value(s), and time. Previous sample locations that are resampled during the field activities will use the previously established Site ID consistent with AEC's IRDMIS. All new sites will be assigned Site Identifications consistent with those already in existence. The data will be prepared by ETA then loaded into IRDMIS. Management of IRDMIS data consists of proper formatting and loading of IRDMIS Map Data and IRDMIS geotechnical data.

7.2.3.2 IRDMIS Map Data

ETA will be responsible for providing AEC with map files based on the ETA's field efforts at the DRMO Yard. ETA will follow the procedures discussed in Chapter 3 of the PC Data Entry & Validation Subsystem User's Manual to enter map data into IRDMIS. IRDMIS map data entry registers sampling locations by a specific naming convention and a coordinate system.

The naming convention consists of a Site Type of four characters and a ten character Site Identification. Examples of Site Types are WELL, BORE, and LAKE (see Section 9.17 of the Data Dictionary). An example of Site ID is WBP-93-01 (see section 9.16 of the Data Dictio nary). Once a site has been named, that same unique name must be used throughout that site's sampling history.

The coordinate system can be either Universal Transverse Mercator (UTM) or State Planar (STP). Maryland State Plane Coordinate System will be used for the survey in this project.

Some of the necessary elements required in a map file are:

(1) Installation
(2) Site Type
(3) Site Identification
(4) Coordinate System
(5) Coordinate Source
(6) Coordinate Accuracy
(7) X Coordinate
(8) Y Coordinate
(9) Base Closure Indicator

All other elements can be considered optional or have default values, but should eventually be entered for completeness.

ETA will transfer the data into an ASCII file which will be sent to Potomac Research, Inc. for processing, validation, and loading to the AEC legal repository.

7.2.3.3 IRDMIS Geotechnical Data

In addition to the map files, ETA will provide USAEC with geotechnical files for ETA's sampling efforts at the DRMO Yard. As new water level measurements are completed, ETA will follow the procedure discussed in Chapter 2 of the PC Data Entry & Validation Subsystem User's Manual to enter geotechnical data into IRDMIS.

There are three types of geotechnical data that ETA will be responsible to enter and keep updated as the project at the DRMO Yard continues. They are Geotechnical Well Construction (GWC) data, Geotechnical Field Drilling (GFD) data, and Geotechnical Ground Water Stabilized (GGS) data. GWC and GFD data files will be created for each new well that is drilled and constructed in association with ETA's activity at the DRMO Yard.

Some of the required elements in addition to the Site Type and Site ID for Geotechnical Data entry for the well construction information are:

For GWC file:

(1) Prime Contractor
(2) Well Construction Date
(3) Action/Measurement

For screened wells, the GWC file requires the following Action/Measurements data:

DPTOT - Direct measurement of depth from ground surface to the deepest point encountered during drilling and/or sampling in a bore hole.

STKUP - Field measurement of length of PVC riser above ground surface.

CASE - Direct measurement of length from ground surface to top of the screen of an overburden well.

CASED - Direct measurement of the inside diameter of the casing of an overburden well.

SCREN - Length of the screen of an overburden (screened) well.

GROUT - Length of the interval filled with neat cement or cement grout for an

overburden well.

BSEAL - Measurement of length of bentonite seal of an overburden well.

GFILT - Direct measurement of length of gravel filter or sand pack of an overburden well.

All other Action/Measurement data are optional.

For GFD file:

(1) Prime Contractor
(2) Bore Start Date
(3) Action/Measurement

The GFD requires the following Action/Measurement data:

DPTOT - Direct measurement of depth from ground surface to the deepest point encountered during drilling and/or sampling in a bore hole.

GRDWT - Direct or estimated measurement of depth from ground surface to first-encountered ground water level at time of drilling.

NOGWT - No ground water encountered at time of drilling.

USCS - Visual classification in the field for an interval using the Unified Soil Classification System.

All other Action/Measurement data are optional.

GGS geotechnical data files will be created for each field measurement of stabilized ground water levels. The levels will be gathered and entered for every well that will be sampled including new and existing well sites. For GGS files, the following data are required:

(1) Prime Contractor
(2) Water Level Measurement Date
(3) Action/Measurement

For Action/Measurement data, the depth to the ground water level will be the entry.

ETA will then transfer the GWC, GFD, and GGS data into ASCII files which will be sent to PRI for processing, validation, and loading to IRDMIS.

Further information on Action/Measurement requirements for GWC, GFD, and GGS files are listed in the USAEC Data Dictionary.

8.0 RISK ASSESSMENT, FEASIBILITY STUDY, AND COMMUNITY RELATIONS

8.1 Human Health and/or Ecological Risk Assessment

8.1.1 Introduction

If there is a hydrologic pathway from the DRMO Yard to the BRAC Land Parcel, ETA will conduct a limited human health and/or ecological risk assessment for the DRMO Yard. If it is determined that there is a ground water connection then only a human health risk assessment will be accomplished. If a surface water connection is established, then both a human health and ecological risk assessment will be accomplished. Both carcinogenic and non-carcinogenic risks will be estimated based on the ingestion of ground water.

The Risk Assessment (RA) will be conducted according to the guidance provided in the following: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part A - Interim Final and the Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". Additional information or guidance published in the Federal Register or issued by EPA Region III may also be used as supplemental information. The public health risk assessment will consist of the five principal components: hazard identification, dose-response assessment, exposure assessment, risk characterization, and limitation/uncertainties.

The objective of the RA will be to assess and quantify the risk for potential present and future human health and ecological exposure due to exposure to the contaminants in the ground water and/or surface water at the DRMO Yard, assuming that no remedial action will occur.

Performing the limited RA will require the assumption that exposure to contaminants at the site will occur under the following conditions: no remediation will occur, calculated risks are based on actual land uses and potential future usage assuming no remedial action, risks are calculated based on current contaminant concentrations, assuming no natural decrease.

8.1.2 Hazard Identification

During the hazard identification, the chemicals of potential concern for the site will be identified by evaluating the analytical data and identifying suitable sets for quantitation. The identification will include both the ground water and the surface runoff pathway.

The hazard identification will be performed using only Level III IRDMIS data. For calculation of exposure point concentrations for detected chemicals, non-detects will be included in the calculation of average exposure concentrations as one-half the reported sample quantitation limit. The acceptability of qualified data for use in risk assessment will be determined through a review of the IRDMIS qualifiers and the magnitude of the associated uncertainty. Data validation will also be accomplished in accordance with the EPA Region III modifications to the National Functional Guidelines for Evaluating Organics and Inorganics Analyses. Rejected results will

not be included in the computation of mean or statistical data.

Prior to computation of the mean exposure concentration, duplicate samples will be averaged. This method of calculation is conservative and minimizes the impact of sample analysis uncertainty on the computed arithmetic means. All applicable ARARs for both ground water and surface runoff will be taken into account.

Summary statistics of the analytical data will be generated for each constituent detected in each medium and will include the following:

- Number of detects
- Arithmetic average concentrations
- 95th percent confidence limit on the mean
- Maximum detected concentrations
- Location of the maximum detected concentrations
- Depth at which the sample was taken
- Number of samples

Ground water and surface runoff tables will also include the maximum contaminant level (MCL), maximum contaminant level goal (MCLG), and the number of samples that exceed each.

The selection of contaminants of concern for the human health and ecological risk assessment will be based on the following guidelines:

- Chemicals in ground and/or surface waters will be screened to determine those that pose the greatest risk; these will be retained as chemicals of potential concern for the risk assessment.

- Metals may be eliminated from consideration if they are essential nutrients present at beneficial concentrations.

Risk assessment activities will begin at the time of receipt of a complete set of IRDMIS Level III data from Datachem.

If compounds are eliminated from the quantitative evaluation they will be discussed in the text of the report.

8.1.3 Dose-Response Assessment

During the dose-response assessment, the toxicity of the contaminants will be reviewed and the toxicity parameters that EPA recommends for public health and ecological risk assessment will be identified. There are two primary sources of toxicity values that will be used. The Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Tables (HEAST). IRIS reports only those toxicity values that have been verified by a USEPA RfD or Carcinogen Risk Assessment Verification Endeavor (CRAVE) work group. Information in IRIS will supersede all other sources and other sources will be consulted only if information is not available in IRIS for a chemical of concern will. If data are not available from IRIS, HEAST will be used. HEAST summarizes interim toxicity values as well as other chemical-specific toxicological information.

8.1.4 Exposure Assessment

During the exposure assessment a limited number of exposure pathways, current and future will be assessed. Particularly, only the ingestion of and inhalation of vapors from and dermal contact with ground water, dermal contact with and incidental ingestion of surface water by a recreational user, and ingestion of ground water by future industrial workers, will be assessed. The exposure pathways will be evaluated because this RI/FS is limited in nature and intended to only determine the impact the DRMO parcel may have on the BRAC parcel.

The exposure assessment will take into account current and future land use and determine the exposure point concentrations that will be used to characterize the risk will be determined. The exposure assessment will use the guidelines in Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors".

A complete exposure pathway consists of the following elements:

- A source and mechanism of release
- An environmental transport medium for the released chemical (Pathway)
- A receptor and a point of potential human or other environmental organism contact with the contamination

The characterization of the population that may be exposed is the first step in the exposure assessment. Examples of information that must be assembled include climate, geology, vegetation, soil types, and hydrology.

A description of the physical setting and the potentially exposed populations, together with the results of the RI field sampling and analysis program, will be used to evaluate the presence or absence of, or potential for exposure to, compounds present at the DRMO Yard.

Based on conservative assumptions developed in accordance with federal guidance, chronic daily intakes (CDIs) will be calculated for each compound and receptor at each exposure point.

Exposure point concentrations and resulting CDIs for both oral and dermal exposure routes will be based on direct contact with the media of concern using chemical concentrations pathways of contaminant migration obtained from the analysis of samples collected during the RI.

8.1.5 Risk Characterizations

During the risk characterization step the information on dose and toxicity is combined with the exposure information to assess the potential for adverse effects to human health. Hazard quotient and excess cancer risk will be determined for each compound associated with a pathway for which toxicity criteria are available.

The hazard quotient for each compound will be calculated for each pathway and exposure period by dividing the CDI by the reference dose (RfD). The Hazard Index (HI) is computed by adding the hazard quotient for each detected chemical within each exposure pathway.

HI >1 assess target organs to check additive critical effect.

The excess lifetime cancer risk will be calculated for each chemical by multiplying the CDI by the cancer potency slope. The excess risks for all chemicals are added to approximate risk from each exposure pathway.

8.1.6 Uncertainties/Limitations

Data gaps will be identified along with resulting uncertainties in the calculated risks. Additionally, uncertainties associated with sample data characterizing the site; procedures for modeling environmental fate and exposure; uncertainty in developing toxicity parameters, including the use of uncertainty factors and confidence intervals; and extrapolations of toxicity parameters across exposure routes will be discussed.

8.2 Feasibility Study

ETA will conduct a feasibility study of the DRMO Yard if it is confirmed that contamination is migrating via ground water or surface water from the DRMO Yard to the BRAC Land Parcel. This FS will be conducted using the EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. The objective of this FS is to develop remedial alternatives that address potential unacceptable risks to human health and the environment posed by contaminated ground water and/or surface water.

The FS will include the development and evaluation of alternatives that will allow selection of remedial actions that: demonstrate short-term effectiveness, demonstrate long-term effectiveness and performance; reduce the toxicity, mobility, or volume of chemical hazards present can be implemented; are cost effective; comply with the Applicable or Relevant and Appropriate Requirements (ARARs); are protective of human health and the environment; are acceptable to

Pb by uptake biokinetic model

the appropriate regulatory agencies; and are acceptable to the community. A Proposed Plan, Responsiveness Summary, and a Record of Decision will be performed as part of the FS and submitted as separate documents.

In addition to following the EPA guidance for conducting the RI/FS, ETA will meet the following expectations required by the NCP.

- Development of engineering controls for materials that pose a low-level threat or where treatment is impracticable

- Determination of appropriate combinations of controls (i.e., treatment and containment)

- Inclusion of institutional controls for mitigation of short-term impacts and/or as a supplement to engineering controls

- Employment of innovative technologies where there is a reasonable belief that they may perform as well as, or better than, conventional technologies

- Return of ground water to its beneficial uses within a reasonable time frame

- Use of treatment to address principal threats wherever practicable.

8.2.1 Develop and Screen Alternatives

ETA will develop remediation alternatives that address ground water and/or surface water contamination associated with the DRMO site. As appropriate, the range of remedial alternatives will include source control actions that employ treatment as a principal element or rely on containment, with little or no treatment, to ensure protection of human health and the environment. Alternatives for ground water response actions will address site-specific cleanup levels and restoration time frames necessary to achieve remedial action objectives. ETA will also consider alternatives that employ innovative treatment technologies. Finally, ETA will develop a no-action alternative that will be retained throughout the development and screening process as a interrelated development and screening process as described in the following sections.

- Alternatives Development
    - Development of remedial action objectives
    - Development of General Response Actions
    - Identification of the volumes of ground water and surface water to be remediated
    - Identification and screening of remedial technologies and process options
    - Evaluation of process options
    - Assembling of the selected representative technologies into alternatives

- Alternatives Screening
  - Definition of alternatives
  - Screening of alternatives
  - Evaluation of alternatives

8.2.1.1 Alternative Development

The remedial action objectives will specify contaminants of concern for each affected medium, potential exposure pathways and the preliminary remediation goals. ETA will also develop general response actions, which include a list of potential technology types and technology process options, that are intended to satisfy the remedial action abjectives.

The initial area or volume of media which needs to be treated will be determined and this determination will take into account the interaction of the ground water and surface water. As the RI progresses the area or volume will be updated and final size or volume used will be dependent on the exposure pathways, the nature and extent of contamination, the preliminary remediation goals, and action-specific ARARs.

Technology types and process options will initially be eliminated or "screened" on the basis of technical implementability. The remaining technology types and process options will be evaluated with respect to effectiveness, implementability and cost in order to select a representative process option for each technology type. Technology process options are evaluated under criteria identical to those used when csreening alternatives prior to the detailed analysis. Although several innovative technologies may be considered, it may not be possible to evaluate these technologies or associated process options to the same extent as demonstrated technologies. However, if available information indicates that an inovative technology/process option will provide comparable or superior treatment performance, cause fewer adverse impacts or result in lower costs, it will be retained for further evaluation.

After screening candidate technologies and selecting representative process options, it may be necessary to collect additional data through treatibility studies to assess process limitations and/or establish design criteria. Treatibility studies may not be necessary in cases where sufficient information already exists regarding the performance of a treatment process with respect to the media and contaminants of potential concern at the DRMO site. As the final step in the alternatives development process, remedial alternatives will be assembled by combining general resonse actions for applicable media and potential contaminants of concern with remaining technology process options in a manner that attains remedial action objectives.

8.2.1.2 Screen Alternatives

Prior to the actual screening process, it may not be possible to identify details for each process option, determine technology sizing requirements, determine the volume of media requiring treatment or predict remediation time frames. Moreover, interactions among media and specific requirements for protecting human health and the environment may not be fully addressed. ETA

will further evaluate the assembled alternatives to ensure that they are protective of human health and the environment with respect to potential exposure pathways and contaminants of concern. If a large number of viable alternatives have been assembled, it may be necessary to perform an additional screening process, each alternative is evaluated with respect to effectiveness, implementability and cost criteria.

Effectiveness refers to the degree to which an alternative reduces toxicity, mobility and/or volume through treatment; minimizes residual risk; affords long-term protection; complies with ARARs; minimizes short-term impacts; and achieves protection rapidly. Alternatives determined to be significantly less effective or that do not provide adequate protection of human health and the environment will be eliminated from further consideration.

Implementability is determined by assessing the technical feasibility, administrative feasibility, and availability of alternatives. Alternatives that are technically or administratively infeasible may be eliminated. Additionally, alternatives that would require equipment, specialists, or facilities that are not available within a reasonable period of time, will be eliminated as considerations.

Costs associated with construction and long-term operation and maintenance will also be considered. Alternatives with costs that are excessive compared to the overall effectiveness they provide will be eliminated. Other alternatives providing effectiveness and implementability similar to those of other alternatives, but at a greater cost, will also be eliminated.

8.2.2 Detailed Analysis of Alternatives

To allow the Army to select a site remedy, a detailed analysis of remedial alternatives must be accomplished. The detailed analysis of each alternative will be developed based on the statutory requirements of CERCLA and will be performed in accordance with NCP requirements. They will also be assessed against the nine evaluation criteria developed to address the CERCLA requirements. These criteria are:

- Threshold Criteria
  Overall protection of human health and the environment
  Compliance with ARARs

- Primary Balancing Criteria
  Long-term effectiveness and permanence
  Reduction of toxicity, mobility or volume
  Short-term effectiveness
  Implementability
  Cost

- Modifying Criteria
  Support agency acceptance
  Community acceptance

The alternatives will be compared to identify the key tradeoffs among them. In this manner decision makers will be provided sufficient information to adequately compare the alternatives and select an appropriate remedy which will demonstrate the satisfaction of CERCLA remedy selection requirements in the ROD.

8.2.2.1 Definition of Alternatives

The alternatives will be reviewed to determine if any additional information is required to apply the evaluation criteria consistently and to develop order-of-magnitude cost estimates. Examples of additional information developed may include: preliminary design calculations, process flow diagrams, sizing of key process components, preliminary site layouts, and a discussion of limitations, assumptions, and uncertainties concerning each alternative.

8.2.2.2 Overview of Evaluation Criteria

The nine evaluation criteria can be considered as three distinct groups based on their role in the remedy selection process. The "threshold criteria", Overall Protection of Human Health and the Environment and Compliance with ARARs, relate to specific statutory requirements in CERCLA. Each alternative must be protective of human health and the environment and comply with state and federal ARARs, unless an ARAR waiver is justified, inorder to be eligible to be eligible for selection under CERCLA. This ARARs assessment would also include any "to-be-considered" advisories, criteria or guidance that the lead and support agencies agree are appropriate for use in a particular alternative.

The second group consists of "primary balancing criteria" that represent the technical basis for conducting the detailed analysis of alternatives. These criteria include:

- Short-Term Effectiveness - The assessment against this criterion will examine the effectiveness of the alternatives in protecting human health and the environment during construction and implementation of a remedy until response action objectives have been attained.

- Long-Term Effectiveness and Permanence - The assessment of the alternatives against this criterion will evaluate the long-term effectiveness of the alternatives in protecting human health and the environment after response objectives have been met.

- Reduction of Toxicity, Mobility, and Volume - The assessment against this criterion will evaluate the anticipated performance of the specific treatment technologies.

- Implementability - The assessment will evaluate the technical and administrative feasibility of alternatives and the availability of required resources.

- Cost - This assessment will evaluate the capital and O&M costs of each alternative.

The "modifying criteria", Support Agency Acceptance and Community Acceptance, will be considered, to the extent that support agency and community concerns are known, during preparation of the proposed plan. After issuance of the proposed plan and completion of the public comment period, both criteria will be evaluated and discussed in the ROD.

8.2.2.3 Individual Analysis of Remedial Alternatives

The individual analysis of alternativeswill evaluate the performance of each alternative against the threshold criteria and primary balancing criteria. The strengths and weaknesses of a particular alternative will be discussed in terms of each criterion. This discussion will be sufficiently detailed to allow decision-makers to understand significant and controversial aspects, as well as performance uncertainities, associated with each alternative. The modifying criteria will be addressed after the proposed plan and public comment period.

8.2.2.4 Comparative Analysis of Remedial Alternatives

After being described and individually assessed against the evaluation criteria, ETA will perform a comparative analysis to evaluate the relative performance of each alternative in relation to each specific evaluation criteria. The purpose of this comparative analysis is to identify the advantages and disadvantages of each alternative to one another so that the key tradeoffs can be identified.

The strengths and weaknesses of the alternatives relative to one another with respect to each evaluation criterion will be documented in the FS.

8.3 Community Relations Support

ETA will supply support for the investigation's Public Involvement and Response program. This support will be based on Public Involvement and Response Plan for Fort Meade and will consist of preparing for one public meeting on the installation as specified by the AEC.

9.0 PROJECT MANAGEMENT

9.1 Organization Structure

Figure 9 presents the key ETA staff and the organizational structure established for the completion of the RI/FS. A brief description of the responsibilities for each of the key staff is shown on that figure.

Donald H. Koch, P.E. is the Program Manager for the overall USAEC Total Environmental Program Support (TEPS) contract. He will be responsible for the overall quality of the project and will review and approve all work products, and review and approve all deliverables before submission to USAEC. He will monitor financial and schedule control, and institute corrective action if necessary.

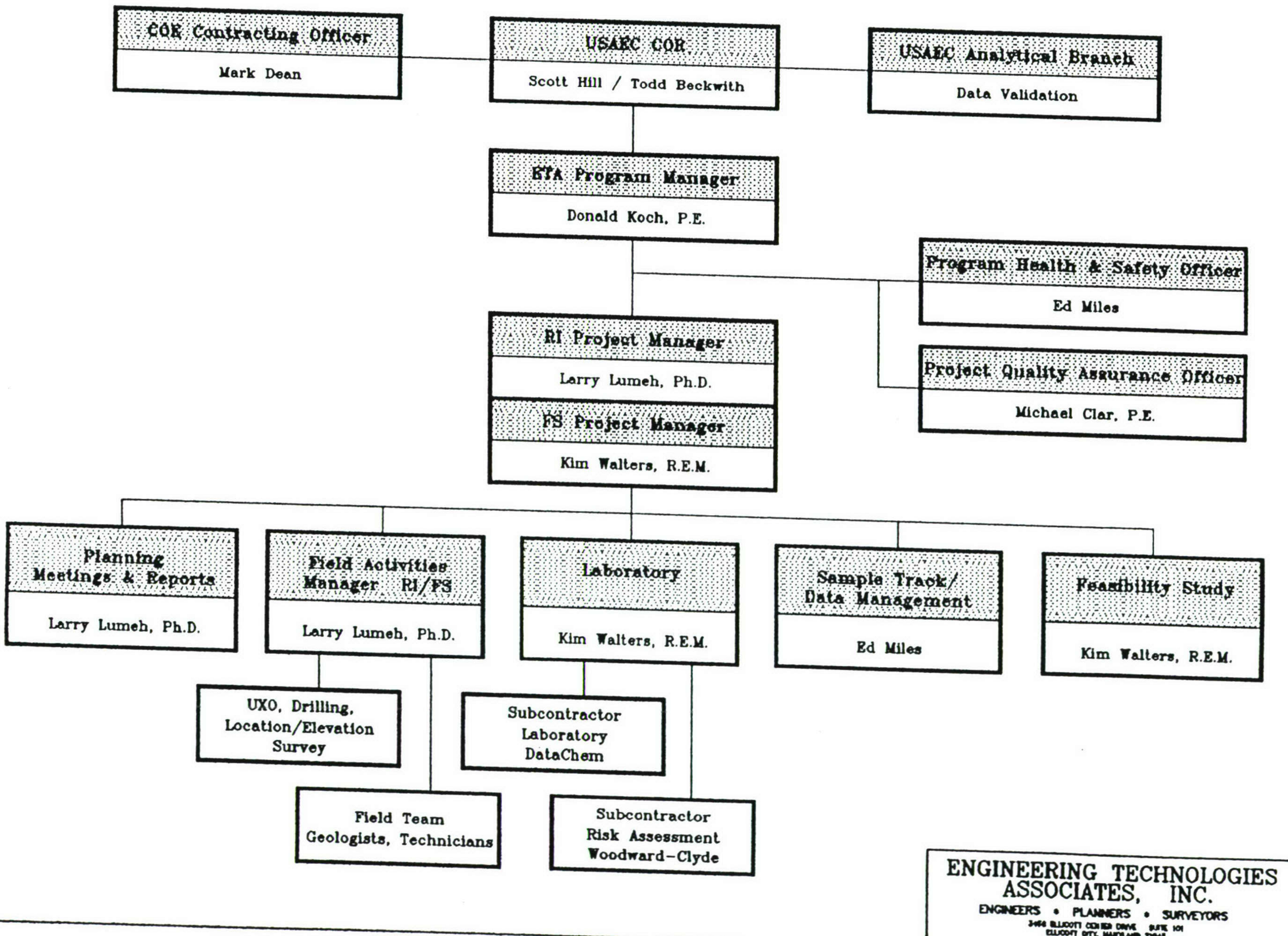
Larry Lumeh, Ph.D. is the RI Project Manager and he will be responsible for the staffing and direct management of the field investigation portion of the project. He will review and approve all deliverables, recommending corrective action if necessary. He will regularly communicate with Scott Hill regarding the progress of the project.

Kim Walters, R.E.M. is the FS Project Manager and he will be responsible for the staffing and direct management of the feasibility study portion of the project. During this phase of the project he will review all deliverables, recommending corrective action if necessary. He will regularly communicate with Scott Hill regarding the progress of the project.

Edward Miles is ETA's Health and Safety Officer and he will be responsible for writing the Health and Safety Plan (HASP) for the project. He will brief the on-site Health and Safety Officer and ensure that all procedures are followed.

FIGURE : 9

DRMO RI / FS ORGANIZATION CHART



10.0 SCHEDULE

10.1 Overall Project Schedule

The proposed schedule was developed to meet the contract requirements after receiving clarification from Scott Hill the COR. The progress of the project is to a degree dependent upon weather conditions. If this or other problems are encountered, changes in the schedule will only occur after consultation with Scott Hill.

10.2 Deliverables

Two reports will be generated as a result of this investigation of the ground water and surface water at the DRMO Yard. The Remedial Investigation and the Feasibility Study. These reports will be delivered for review by the Army in Draft, Draft Final and Final format. The three iterations will be reviewed by several different agencies and ETA will incorporate comments as directed by the USAEC.

The RI will include all the information derived as a result of the field investigation and the risk assessment. It will be written in accordance with EPA guidance and conform to all USAEC guidelines.

The FS report will include a summary of all remedial alternatives, and a description of the screening and evaluation process. It will include a summary of the detailed technical and cost evaluations and a comparative evaluation of all remedial alternatives. Identification of chemical-, action-, and location-specific ARARs will be included in the FS report based on consultation with EPA and MDE. As necessary and appropriate, the FS report would also include a list of "to-be-considered" advisories, criteria or guidance.

When the Preferred Alternative has been identified, ETA will prepare the Proposed Plan. The Plan will be based on EPA guidance for the preparation of Superfund Decision Documents and will comply with the NEPA. A summaryof the community's involvement during selection of the preferred remedial alternative in the proposed plan will be included as part of the Responsiveness Summary section of the ROD.

The remedial alternative decision will be documented in the Record of Decision (ROD) and will include the following information:

- Certification that the remedy selection process was carried out in accordance with CERCLA and the NCP

- Description of the technical parameters of the remedy, specifying treatment, engineering, and institutional components as well as remediation goals

- Notification that information used to support remedy selection at the DRMO site is available for public review in the Administrative Record, which is located in the FGGM Information Repositories.

11.0 REFERENCES

U.S. Environmental Protection Agency (EPA). Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. (Interim Report). EPA/540/G-89/004. October 1988.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports. March 1987.

U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). Quality Assurance Program. January 1990.

Arthur D. Little, Inc. Final Technical Work Plan, Feasibility and Remedial Investigation/Site Inspection Addendum. Fort George G. Meade, Maryland. December 1992.

U.S. Environmental Protection Agency (EPA). Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part A - Interim Final.

OSWER Directive 9285.6-03. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." March 1991.

U. S. Environmental Protection Agency (EPA). Health Effects Assessment Summary Tables (HEAST). 1991a, 1992.

OSWER Directive 9285.6-03. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," March 1991.

Hunter/Environmental Science & Engineering, Inc. Public Involvement and Response Plan for Fort George G. Meade, Maryland. September 1990.

Arthur D. Little, Inc. Quality Control Plan (QCP) for Fort Meade, Maryland. December 1992.

Arthur D. Little, Inc. Health Plan for Fort Meade, Maryland. December 1992.

U. S. Environmental Protection Agency (EPA). Test Methods for Evaluating Solid Waste. SW846 Third Edition and Revisions/Updates. 1986.

U. S. Army Corps of Engineers. Chemical Data Quality Management for Hazardous Waste Remedial Activities. ER1110-1-263. October 1990.

EA Engineering, Science, and Technology, Inc. Base Closure Parcel Site Inspection Study. October 1992.